

ISSN 0253-4924

# FOOD TECHNOLOGY *Abstracts*

**Vol. 29 No. 10 October 1994**



**Central Food Technological Research Institute, Mysore  
National Information System for Science and Technology  
Department of Scientific and Industrial Research, New Delhi.**

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# **FOOD TECHNOLOGY ABSTRACTS**

**Vol. 29 No. 10**

**October 1994**

**National Information Centre For Food Science And Technology  
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Annual Subscription : Rs.300.00. US \$ 90.00. Single Copy : Rs.30.00

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## ABBREVIATIONS

A	ampere
AAS	atomic absorption spectrometry
ADP	adenosine diphosphate
Anon.	Anonymous
AOAC	Association of Official Analytical Chemists
approx.	approximately
atm	atmosphere
ATP	adenosine triphosphate
$a_w$	water activity
BHA	butylated hydroxyanisole
BHT	butylated hydroxytoluene
b.p.	boiling point
Btu	British thermal unit
c-	centi- [as in cm, cm <sup>2</sup> , cm <sup>3</sup> ]
cal	calorie
cd	candela
°C	degree centigrade
Cl	curie
CMC	carboxymethyl cellulose
coeff.	coefficient
conc.	concentrated
concn.	concentration
cv.	cultivar
cwt	hundredweight
d-	deci-
DE	dextrose equivalent
detn.	determination
DFD	dark firm dry
diam.	diameter
dil.	dilute
DM	dry matter
DNA	deoxyribonucleic acid(s)
dyn	dyne
E.	East, Eastern, etc
ECD.	electron capture detection
EDTA	ethylenediaminetetraacetic acid
Eh	oxidation-reduction potential
ELISA	enzyme-linked immunosorbent assay
f-	femto- [10 <sup>-15</sup> , as in fCi]
°F	degree Fahrenheit
FAO	Food and Agricultural Organization
FDA	Food and Drug Administration
FID	flame ionization detection
fl oz	fluid ounce
f.p.	freezing point
ft	foot, feet
g	gram
GC	gas chromatography

gr	gravity
gal	gallon
gf	gram-force
GLC	gas-liquid chromatography
h	hour
ha	hectare
HDPE	high density polyethylene
hl	hectolitre [100 l]
hp	horse power
HPLC	high performance/pressure liquid chromatography
HTST	high temperature short time
Hz	hertz [frequency cycles/s]
in	inch
IR	infrared
IU	international unit
J	Joule
k-	kilo- [as in kcal, kg]
K	Kelvin
l	litre
lb	pound
lbf	pound-force
LDPE	low density polyethylene
m-	milli- [as in mg, ml, mm]
m-	equimilli-equivalent
M	molar concentration
M-	mega- [as in Mrad]
max.	maximum
min	minute [time]
min.	minimum
mol	mole
mol.wt.	molecular weight
m.p.	melting point
MPN	most probable number
MS	mass-spectrometry
n-	nano- [10 <sup>-9</sup> , as in nm]
N	Newton [kg m/s <sup>2</sup> ]
N.	North, Northern, etc
N	Normal concentration
NMR	nuclear magnetic resonance
NPU	net protein utilization
oz	ounce
p-	pico- [10 <sup>-12</sup> , as in pCi]
P	Poise
p	probability
Pa	pascal (N/M <sup>2</sup> )
PAGE	polyacrylamide gel electrophoresis
PER	protein efficiency ratio
p.p.b.	parts per billion
p.p.m.	parts per million
PSE	pale soft exudative
PTFE	polytetrafluorethylene
PVC	polyvinyl chloride
PVDC	polyvinylidene chloride

qt	quart
R	rontgen
rad	rad or radian
ref.	reference(s)
rev/min	revolutions per minute
RH	relative humidity
RNA	ribonucleic acid(s)
S.	South, Southern, etc.
s.d.	standard deviation
SDS	sodium dodecylsulphate
s.e.	standard error
s	second [time]
SNF	solids-not-fat
sp., spp.	species
sp.gr.	specific gravity
summ.	summary
Suppl.	Supplement
t	metric tonne
temp.	temperature
TLC	thin layer chromatography
TS	total solids
UHT	ultra-high temperature
UV	ultraviolet
V	volt
var.	variety
vol.	volume
v/v	volume/volume
W	watt
W.	West, Western, etc.
WHO	World Health Organization
w/v	weight/volume
wk	week
wt.	weight
yd	yard
yr	year
μ	micro- [as in g, μm]
%	per centum
>	greater than
≥	greater than or equal to; not less than
<	less than
≤	less than or equal to; not greater than

## ABBREVIATIONS FOR LANGUAGES

### Language of text

Dutch	Nl
French	Fr
German	De
Italian	It
Japanese	Ja
Norwegian	No
Spanish	E
Swedish	Sv

demonstrating the feasibility of this approach when a single marker is monitored. BV

1845

Awuah (GB), Ramaswamy (HS), Simpson (BK) and Smith (JP). **Thermal inactivation kinetics of trypsin at aseptic processing temperatures.** *Journal of Food Process Engineering* 16(4); 1993; 315-328

Thermal inactivation (TI) kinetics of trypsin (bovine pancreas) were evaluated in the temp. range, 90-130°C, common to aseptic processing of high/low acid foods. Aliquots of trypsin in buffer, at 3 pH values, 3.8, 5.1 and 6.0, were subjected to selected heat treatments at various temp. Kinetic parameters were evaluated from the residual enzyme activity. Reference k and D values (at 121.1°C) ranged from 0.0719 to 0.349 min<sup>-1</sup> and 32.0 to 6.6 min, and Ea and z values ranged from 84.9 to 69.9 kJ/mole and 33.1 to 39.9°C, respectively, in the pH range 3.8-6.0. The TI resistance of trypsin in the acid and low acid pH range makes it a potential bioindicator for high temp. thermal processes. BV

1846

Ross (EW). **Relation of bacterial destruction to chemical marker formation during processing by thermal pulses.** *Journal of Food Process Engineering* 16(4); 1993; 247-270

Reports a formulation, in dimensionless terms, of the equations pertaining to first-order processes that follow Arrhenius kinetics; the formulation was applied to problems in food thermoprocessing. The purpose of the exercise was to attempt to understand the relationship between destruction of pathogenic microorganisms and the formation of chemical markers in foods during processing; markers and microorganisms are affected by thermal pulses during processing. The dimensionless formulation makes it possible to derive equations expressing the relationship between the decadic reduction in microbial population and the rise in marker concn. for temp.-time profiles previously not readily calculable. Measurements of markers in foods can therefore be used to predict destruction of microorganisms in foods during processing. Examples are given of calculations

1847

Kumagai (H), Kumagai (H) and Yano (T). **Critical bubble radius for expansion in extrusion cooking.** *Journal of Food Engineering* 20(4); 1993; 325-338

Strong wheat flour (WF), weak WF and rice flour were expanded by sudden reduction in pressure at the discharge port of an extruder. The micropore-vol. (MV) distributions were measured by N adsorption isotherms. Results were compared with the theoretical critical radius for expansion (TCRE) calculated from the balance of forces acting inside and outside a bubble. The MV near the TCRE of an extrudate decreased markedly after extrusion cooking, indicating that the TCRE almost coincided with the experimental one. AA

1848

Caudill (VE), Halek (GW) and Heldman (DR). **Effects of heat and peroxide processing conditions on deformation and barrier properties of thermoformed polypropylene aseptic containers.** *Journal of Food Engineering* 20 (2); 1993; 183-197

The behaviour of isotactic polypropylene containers was studied when exposed to various sterilization treatments. A method of reproducing and identifying sterilization treatments using H<sub>2</sub>O<sub>2</sub> and heated air was developed for solid-phase thermoformed containers. Air-drying temp. of 200, 300 or 400°C gave container inside surface temp. of 104, 116 and 124°C, respectively. A uniform spray pattern of 18.4 plus/minus 0.5 mg of H<sub>2</sub>O<sub>2</sub> in each container was accomplished. Polypropylenes of various crystalline structures gave dimensional changes as great as 3% but did not produce observable effects on water or oxygen transmission rates. Resin composition demonstrated greater effect on container properties and behaviour than sterilization treatments. AA

1849

Nunes (RV), Swartzel (KR) and Ollis (DF). **Thermal evaluation of food processes: the**

**role of a reference temperature.** *Journal of Food Engineering* 20(1); 1993; 1-15

Thermal evaluation methods for food processes are derived from either the Arrhenius or the Bigelow models; among them the thermal death time method (TDTM) with  $z = 10^{\circ}\text{C}$  and the equivalent point method (EPM) are of particular interest. Incorporation of a reference temp. ( $T_{\text{Ref}}$ ) into these 2 methods is examined for both low- and high-temp. thermal processing. 4 examples are presented, covering batch and continuous operations. For  $T_{\text{Ref}} = 121.11^{\circ}\text{C}$ , the TDTM for a typical canning operation yields a processing time 7% larger than that of the EPM; by contrast, applying the TDTM to continuous processes may result in large underestimations of the processing time, i.e. between 30-40% lower than those of the EPM. To avoid such underestimations, a new  $T_{\text{Ref}} = 145.0^{\circ}\text{C}$  is proposed, which is obtained by setting the first derivative of the Arrhenius equation equal to  $1/z$ . In this way, the design of thermal processes can be achieved with only small overestimation or negligible underestimations. In addition, the EPM makes it possible to evaluate easily F and G values for the Bigelow and Arrhenius models, respectively. AA

## FOOD PACKAGING

1850

Lehr (KM), Welsh (GC), Bell (CD) and Lickly (TD). **The 'vapour-phase' migration of styrene from general purpose polystyrene and high impact polystyrene into cooking oil.** *Food and Chemical Toxicology* 31(11); 1993; 793-798

General purpose and high impact polystyrene (GPPS and HIPS, respectively) are used in many food packaging applications. In some packaging configurations, where there is no direct contact of a liquid surface with the polymer, 'vapour-phase' migration of styrene monomer from the polymer with subsequent absorption into food is thought to be a significant mode of transfer. Correlation of residual styrene concn. in polystyrene with vapour-phase styrene migration is of interest in order to predict potential consumer exposure to styrene from food-packaging applications of this configuration. Studies of the migration of

styrene from GPPS and HIPS into air with subsequent absorption of the monomer into cooking oil, 'vapour-phase' migration, was determined in a sealed system. The results showed that for both polymers the amount of styrene migrating from the polystyrene and being absorbed by the oil was proportional to the square root of the time of exposure. The diffusion coeff. calculated for the vapour-phase migration of styrene from both polymers were found to be in good agreement with the diffusion coeff. previously determined for the 'liquid-phase' migration of styrene from similar polymers where the polymers were completely submerged in the cooking oil. These results indicate that the styrene concn. measured in both experiments were attributable to the intrinsic diffusion of styrene from polystyrene, and that contact with cooking oil did not accelerate migration in previous experiments. AA

1851

Sheen (S), Tong (C-H), Fu (FY) and Lund (DB). **Lethality of thermal processes for food in anomalous-shaped plastic containers.** *Journal of Food Engineering* 20(3); 1993; 199-213

A numerical simulation was performed to obtain the temp. distribution in a bowl-shaped plastics container with a metal lid, [destined for use with foods]. The boundary conditions included the 1st and 3rd kinds, which were applied to the lid and the plastics parts, respectively. Due to the curvilinear boundary, a finite volume numerical method was used to calculate the nodal temp., which was verified experimentally. The location of the lowest temp. (cold point) during heating was found by temp. interpolation and rearrangement of nodal points. It was found that the cold point of the bowl-shaped container, using a circulating superheated water-type retort, was located at 0.46 H on the rotating axis above the bottom. However, the lowest calculated total lethality, when including the cooling phase, was at 0.4 H and was 1-2% < the lethality of the cold point (the lowest temp. in the heating phase). AA

1852

Simpson (R), Merino (ASF) and Torres (JA). **Mathematical models and logic for the computer control of batch retorts:**

**conduction-heated foods.** *Journal of Food Engineering* 20(3); 1993; 283-295

A computer program was developed to implement a mathematical model to control on-line batch retort operations for conduction-heated foods. The model is based on a numeric sol. for heat transfer in cylindrical cans. The heat transfer equation was solved using a numeric method with a variable grid. Integrated lethality values are calculated assuming 1st-order kinetics for microbial inactivation, taking into account the cumulative lethality of the heating and cooling period. The program adjusts process time automatically to compensate for any unexpected variation in retort temp., and was validated using processes reported in the literature. The computational speed of the numeric method described could be applied to other calculation-intensive simulations. AA

## FOOD ENGINEERING AND EQUIPMENT

1853

Anon. **Update on RF heating.** *Food Manufacture* 69(1); 1994; 33, 34

Microwave Engineering Designs Ltd., has developed a radio frequency generator that can be used with ancillary equipment to provide a 'dielectric heating system' for the food industry. The role of the technology that has to play in food processing is briefly described. Free running oscillator system, COSMIG (Crystal Oscillator Source Matched Impedance Generator) systems, electromagnetic compatibility are briefly explained. SRA

1854

Merino (ASF), Simpson (R) and Torres (JA). **Time-variable retort temperature profiles for cylindrical cans: batch process time, energy consumption, and quality retention model.** *Journal of Food Process Engineering* 16(4); 1993; 271-287

Reports a batch retort model [for food sterilization] which uses a heat transfer equation for heat conduction in cylindrical cans, 1st order kinetics for microbial

inactivation, 1st order kinetics for quality losses and a transient energy balance (TEB) to estimate steam consumption. For a given retort, lethality process and quality retention, the TEB equation in the model allowed the identification of feasible time-temp. profiles reducing energy consumption, total process time or both. In the examples analysed and depending upon product specification, time-variable retort temp. reduced process time by 18-55 min. These examples suggested that a change from constant to time-variable retort temp. could increase canning capacity by 20-50%. BV

1855

Wang (W-C) and Sastry (SK). **Salt diffusion into vegetable tissue as a pretreatment for ohmic heating: electrical conductivity profiles and vacuum infusion studies.** *Journal of Food Engineering* 20(4); 1993; 299-309

The potential for salt diffusion as a pretreatment for ohmic heating was investigated by soaking potato tissue in aqueous NaCl sol. of various concn. Electrical conductivity profiles were sensitive to salt concn. profiles at concn. greater than 0.01 g/cm<sup>3</sup>, but below this concn. conductivity increases were negligible. Vacuum infusion was effective only in increasing salt concn. in outer layers, indicating that its usefulness was primarily limited to small particles. Electrical conductivity-temp. relations were linear for low concn. NaCl-diffused samples, but at higher salt concn., the curve became nonlinear, possibly as a result of salt equilibration during the heating process. AA

1856

Merino (ASF) and Torres (JA). **Mathematical models to evaluate temperature abuse effects during distribution of refrigerated solid foods.** *Journal of Food Engineering* 20(3); 1993; 223-245

A personal computer-based tool was developed to evaluate the shelf life of refrigerated solid foods in rectangular containers and undergoing temp. abuse. A combined heat transfer and microbial growth model was tested by analysing the effect of temp. abuse on

microbial growth. The program considered the presence of a single microorganism (*Brochothrix thermosphacta*), the effect of packaging material and product dimensions (small, large). Results indicated that even when the fraction of the total storage time at an undesirable room temp. is small (2-3%), the reduction in shelf life can be highly significant (20-30%). Effect of pack size and heat transfer properties was also significant. AA

1857

Kondjoyan (A), Daudin (JD) and Bimbenet (JJ). **Heat and mass transfer coefficients at the surface of elliptical cylinders placed in a turbulent air flow.** *Journal of Food Engineering* 20(4); 1993; 339-367

Heat and mass transfer coeff. were measured at the surface of elliptical cylinders of 3 different lengths (0.10, 0.15 and 0.20 m) and 5 ratios of major to minor axis placed in a cross flow of air. Flow was characteristic of food pilot plants, i.e. air velocity ranging from 0.5 to 2.0 m s<sup>-1</sup> and a turbulence intensity, Tu, of approx. 12%. In agreement with theory, transfer coeff. measured at this turbulence intensity were higher than those usually indicated in chemical engineering literature, which are based on experiments in 'aeronautic' wind tunnels where the turbulence intensity is close to 0%. Air flow properties (air velocity and turbulence intensity) have a greater effect than body shape characteristics (length and ratio). Velocity and turbulence intensity measurements in a chilling room and a drier showed that flow is intermittent and highly turbulent (Tu from 17 to 60%). It is concluded that turbulence should be taken into account in food engineering studies. AA

1858

Pilhofer (GM), McCarthy (MJ), Kauten (RJ) and German (JB). **Phase separation in optically opaque emulsions.** *Journal of Food Engineering* 20(4); 1993; 369-380

Creaming of the dispersed oil phase in opaque oil-in-water emulsions was followed as a function of time and position using proton magnetic resonance. Measurements of T<sub>1</sub> along a vertical slice were used to quantify the oil-phase concn. Emulsions were also

described by laser-diffraction particle-size analysis to compare particle-size analysis with creaming behaviour as determined by T<sub>1</sub> measurements in model triolein-in-water emulsions and more complex milk fat-in-water emulsions. Particle-size distributions failed to accurately predict the measured creaming behaviour in the emulsions studied. Measurements of component nuclear relaxation were useful for characterizing oil-phase migration as a function of surfactant level, dispersed phase vol. and crystallization behaviour of the lipid phase in emulsions. AA

1859

Skjoeldebrand (C) and Ohlsson (T). **A computer simulation program for evaluation of the continuous heat treatment of particulate food products: II. Utilisation.** *Journal of Food Engineering* 20(2); 1993; 167-187

A computer program for calculation of temp. in a liquid containing particles during continuous heat treatment was developed. The program facilitates the study of the influence of processing on product quality in an aseptic processing system. The calculated F value is related to safety and the cook value (C value) is related to quality of the product. Results of calculations using the program are presented. They concentrate on the influence of the processing conditions on the process design. Results indicate that factors such as particle heat transfer coeff., both in the holding tube and in the scraped surface heat exchangers, flow conditions, particle diam. and sterilization temp. have consequences for the holding tube length, i.e. the processing time, for a given lethality. For example, for small particle heat transfer coeff. (< 100 W m<sup>2</sup> K), a small change will have a large effect on the required processing time (i.e. the holding tube length). However, at particle heat transfer coeff. > 150-200 W m<sup>2</sup> K a small change does not greatly affect the processing time (i.e. holding tube length). The program can thus be used to examine whether the surface heat transfer coeff. is the rate-limiting factor, or whether heat conduction inside the particles is more important in the design of the process. AA

1860

Skjoeldebrand (C) and Ohlsson (T). **A computer simulation program for evaluation of the continuous heat treatment of particulate food products. I. Design.** *Journal of Food Engineering* 20(2); 1993; 149-165

Computer simulation programs used by the food industry today are not very well developed, partly because few food processes are easily described by mathematical equations. Heat treatment of food, however, is one group of processes for which mathematical modelling exists. Programs for prediction of the time-temp. relationship for various food products during heat treatment were developed. A specially designed program calculates the temp. in viscous liquid foods with discrete solid particles. This program facilitates study of the influence of processing conditions on product quality in an aseptic processing system. The F value is a measure of safety and a so-called C value (cook value) is a measure of the quality of the product. The simulation program was further developed to take into account product flow rate, residence time distribution, particle size and geometry, equipment specifications, particle load and the thermal properties of the product. The simulation program makes it possible to analyse the entire sterilization system, including cooling, and determine required holding time to research a desired lethality value in the centre of the fastest-moving particle. Design and applications of the program are described. BV

1861

Martinez (OLA), Brennan (JG) and Niranjan (K). **Drying of liquids in a spouted bed of inert particles: heat transfer studies.** *Journal of Food Engineering* 20(2); 1993; 135-148

Experiments were carried out to determine the effect of factors such as air and feed flow rates, inlet air temp. and bed height on the overall volumetric heat transfer coeff., using deionized water in a spouted bed of inert particles. The spouted bed had a conical bottom (semi-vertical angle  $30^\circ$ ) on which was mounted a cylindrical top (0.3 m diam.). Spherical polypropylene beads (3.9 mm diam.) were used as inert particles. Effects of adding a surfactant and a thickening agent to the

aqueous feed on ha values were also reported. Values of ha for all the experiments at various operating conditions ranged from 1.2 to 5.4  $\text{kW m}^{-3} \text{K}^{-1}$ . AA

## Equipments

1862

Sathwane (KN) and Khalatkar (AS). **Rapid and closed seed crusher assembly of microtiter plates for quality analysis.** *Indian Journal of Experimental Biology* 32(9); 1994; 665-667

Microtiter plates with 96 wells are being commonly used in quality analysis in *Brassica* breeding programme. Since, large number of samples are to be handled and seed size is small, crushing of the seeds in individual wells can result in mixing of the samples and precautionary measures are time consuming. Hence, existing microtiter plater were modified by fixing loop and hook fastener tapes in microtiter plates 'A' microtiter plate 'B' and drilling of the holes in 96 wells of the microtiter plates 'B'. Both the plates were imposed over one another and fastened with the over lapping tapes. This provided a closed assembly which could be used for fast crushing of the seed samples and prevent contamination. Use of this closed assembly enabled atleast 50% time saving and enhanced reliability of results. AA

## ENERGY IN FOOD PROCESSING

Nil

## FOOD CHEMISTRY AND ANALYSIS

1863

Atawodi (SE), Maduagwu (EN), Preussmann (R) and Spiegelhalter (B). **Preformed volatile nitrosamines in some Nigerian foodstuffs.** *Food and Chemical Toxicology* 31(11); 1993; 853-855

Some common Nigerian foodstuffs were assessed for their content of preformed volatile nitrosamine by chemiluminescence detection following GC separation. Nitro sodimethylamine levels of between 0.4 and 4.6

p.p.b. were detected in 75% of the samples analysed. The highest value was found in *Brassica oleraceae*, while *Vernonia amygdaline* contained the lowest detectable level. These data suggest that Nigerians may be exposed to chronic but very low levels of carcinogenic nitrosamines in their foods. AA

## Chemistry

1864

Toncheva (G), Hadjikinov (D) and Panchev (I). **Investigation of syneresis of agar jellies with sorbitol.** *Food Chemistry* 49(1); 1994; 29-31

In the process of storing jellies, an effect called syneresis occurs, which appears as a separation of low-mol.-wt. liquid on their surfaces. As an index characterising the quality of jelly-like systems, the syneresis of agar jellies has been investigated with the purpose of creating a suitable composition for the production of jelly products, designed for diabetic patients and nutrition. The influences upon syneresis of storage duration, DM quantity, and agar in the jelly have been investigated. A regression equation of an exponential type has been obtained, expressing syneresis-dependence on DM content and agar in the jelly. An optimal composition has been determined in which agar jellies made with sorbitol show the least tendency towards syneresis. AA

1865

Wedzicha (BL) and Allen (CL). **Kinetic effect of sulphate ion in ester hydrolysis.** *Food Chemistry* 49(1); 1994; 73-75

Sulphite ion unlike acetate ion enhanced ester hydrolysis better than mono- and dihydrogen orthophosphates due to possible nucleophilic attack on ester moiety destabilising ascorbic acid or D-glucon- $\delta$ -lactone by S(IV). SD

1866

Hernandez (CV) and Rutledge (DN). **Characterization of cocoa masses. Low resolution pulse NMR study of the effect of geographical origin and roasting on fluidification.** *Food Chemistry* 49(1); 1994; 83-93

The evolution of solid percentage at 27.5 C for cocoa masses of various geographical origins was studied by Low Resolution Pulse NMR. Modelling of the fluidification curves revealed a bimodal system characterized by two evolution rates and 2 initial solid contents. A multivariate statistical analysis, based on these 4 parameters, separated cocoas according to process and type of roaster used. The results of the same analysis on non-roasted cocoa masses are discussed. AA

1867

Dural (NH) and Hines (AL). **A new theoretical isotherm equation for water vapor-food systems: multilayer adsorption on heterogeneous surfaces.** *Journal of Food Engineering* 20(1); 1993; 75-96

A new analytical isotherm equation that can be applied to water vapour-food systems was developed. The model describes the multilayer adsorption on energetically heterogeneous surfaces by assuming that the local isotherm for a specific site is given by the GAB isotherm, and the distribution of energetically different sites is represented by a generalized exponential function. The new isotherm was tested, using published experimental data [for cereal brans]. Results showed that the model provides an accurate and simple description of adsorption characteristics for heterogeneous adsorbents. AA

## Chemistry (Analytical)

1868

Fardiaz (D). **Determination of oxidation induction period utilising a conductivity meter.** *ASEAN Food Journal* 9(2); 1994; 74-76

The oxidation induction period was determined from the time at which the conductivity increased, indicating the production of oxidation products. Oils containing more polyunsaturated fatty acids had a faster induction period than oil containing less polyunsaturated fatty acids. The addition of antioxidant to the oil lengthened the oxidation induction period. SRA

Yen (Y-H) and Cheryan (M). **Electrodialysis of model lactic acid solutions**. *Journal of Food Engineering* 20(3); 1993; 267-282

Electrodialysis of model lactic acid sol. at various concn., pH values and modes of operation was evaluated in a bench-top system with 20 cell pairs. The limiting current (determined with  $6 \text{ g l}^{-1}$  NaCl) ranged from  $152 \text{ A m}^{-2}$  at a Reynolds number (Re) of 176 to  $304 \text{ A m}^{-2}$  at Re = 419. In the batch recycle mode, the mass of lactate transported increased linearly with time. The flux of lactate was  $328\text{-}456 \text{ g m}^{-2} \text{ h}^{-1}$ ; flux decreased with an increase in feed concn. and with an increase of pH. Water flux during electrodialysis was  $2.79\text{-}3.83 \text{ l m}^{-2} \text{ h}^{-1}$ ; it decreased with an increase in feed concn. and was not affected by pH. This water transport limits the max. lactate concn. in the concentrating stream to  $135 \text{ g l}^{-1}$  with feed concn. of  $45\text{-}95 \text{ g l}^{-1}$ . Coulomb efficiencies with NaCl and lactate solutions in batch, single-pass and feed-and-bleed modes were 0.55-0.8. AA

## FOOD MICROBIOLOGY AND HYGIENE

### Microorganisms

#### Bacteria

1870

Nishikawa (Y), Ogasawara (J) and Kimura (T). **Heat and acid sensitivity of motile Aeromonas: A comparison with other food-poisoning bacteria**. *International Journal of Food Microbiology* 18(4); 1993; 271-278

The number of viable cells of *Aeromonas* and *Vibrio parahaemolyticus* were rapidly reduced after 2 min heating in water at 55 C, while the *Escherichia coli* and *Staphylococcus aureus* gradually declined after 20-30 min. In hamburgers aeromonads showed a marked decrease in numbers of viable cells at 8 min, when temp. exceeded 55 C, and none were recovered after 10 min. By contrast, *Salmonella*, *Staphylococcus* and *E. coli* cells were still recovered in a viable state after 12 min. No *Aeromonas* or *V. parahaemolyticus*

cells were recovered after incubations below pH 3.6 but *E. coli*, *Staph. aureus* and *Sal. typhimurium* were found to be comparatively more resistant to acid. No aeromonads survived for more than 7 h in Japanese seaweed salad seasoned with vinegar. SRA

1871

Marshall (DL) and Odame-Darkwah (JK). **Mechanism of inhibited growth of *Bacillus pumilus* by *Propionibacterium freudenreichii* subsp. *Shermanii***. *International Journal of Food Microbiology* 22(1); 1994; 11-22

Physiological studies were conducted to elucidate the mechanism of inhibition of *B. pumilus* by *Propionibacterium freudenreichii* subsp. *Shermanii*. Inhibition of *B. pumilus* by *P. shermanii* occurred in media supplemented with 1% glucose, indicating that glucose utilization by the *P. shermanii* was not responsible for growth of *B. pumilus* at pH 4.3. Propionic acid was positively identified as inhibitor of growth of *B. pumilus*. Sodium lactate concn. of 0.8-1.0% were essential for continuous growth of *B. pumilus* and production of propionic acid. SRA

### Aeromonas

1872

Kirov (SM), Ardestani (EK) and Hayward (LJ). **The growth and expression of virulence factors at refrigeration temperature by *Aeromonas* strains isolated from foods**. *International Journal of Food Microbiology* 20(3); 1993; 159-168

A potentially significant subset (10%, 6/61) of *Aeromonas* strains isolated from food (milk, lamb, chicken, seafood), all *A. veronii* biotype *sobria*, were able to produce 2 or more exotoxins (haemolysin, enterotoxin, and cytotoxin) at 37 C, and grow well at 43 C. Although mesophilic organisms, they grew at 5 C. In addition, they could adhere to HEp-2 cells when grown at 37 C or at 5 C and expressed flexible pili (possible colonization factors) in greater numbers at the lower temp. These strains, as well as other exotoxin-producing strains (*A. veronii* biotype *sobria* and *A. hydrophila*) (33%, 20/61) lacking

adhesive ability, were able to produce cytotoxins in broth cultures over a 7 to 10-day period at 5°C. One strain in particular, an *A. hydrophila* isolated from goats' milk, grew rapidly at low temp. This psychrotrophic strain produced all 3 exotoxins within 3 days in broth cultures at 5 C. The properties of the above strains suggest they could be of public health significant in food products that have an extended shelf-life at refrigeration temp. AA

### **Escherichia coli**

1873

Hamaker (K) and Tao (BY). **Screening of gamma cyclodextrin-producing recombinant *E. coli* using congo red dye on solid complex media.** *Starch/Staerke* 45(5); 1993; 181-182

Recombinant gene cloning of cyclodextrin glucotransferase (EC 3.2.1.19) bacterial genes into *Escherichia coli* requires a rapid solid media screening analysis for recombinants. A qualitative colorimetric method for detection of  $\gamma$ -cyclodextrins produced from recombinant *E. coli* at neutral pH in complex media using congo red and xylene cyanole dyes is reported. Media were prepared as follows: 1.0% (w/v) tryptone; 0.5% yeast extract; 1.0% NaCl; 1.5% agar; 1.0% potato starch; 100 mg/l congo red dye; and 10 mg/l xylene cyanole FF. Plates were inoculated with cyclodextrin glucanotransferase cloned in *E. coli* and incubated for 24 h at 37°C. Presence of  $\gamma$ -cyclodextrin was identified by the development of clearly defined halos. AA

### **Lactobacillus acidophilus**

1874

Nagendra Shah. **Lactobacillus acidophilus and lactose intolerance: a review.** *ASEAN Food Journal* 9(2); 1994; 47-54

This paper reviews the role of *L. acidophilus* as dietary adjuncts in improving lactose digestion and absorption in lactose malabsorbers. Aspects considered include, survival of *L. acidophilus* under acidic conditions, lactose-hydrolysing enzymes from *L. acidophilus*, effect of *L. acidophilus* in lactose digestion and absorption in lactose malabsorbers, alternate mechanism for

digestion and absorption of lactose by lactase-deficient individuals, and other options for lactose intolerant people. 62 references. SRA

### **Listeria monocytogenes**

1875

Varma (PRG) and Iyer (TSG). **Viability of *Listeria monocytogenes* in water.** *Fishery Technology* 30(2); 1993; 164-165

Water samples inoculated with *L. monocytogenes* were stored at room temp. of 28-30 C and at refrigerated temp. of 5-10 C. They were drawn periodically and enriched in modified trypticase soy broth. The organisms identified was found viable in water for 10-30 days at room temp. and 7-110 days at refrigerated temp. SRA

1876

Campanini (M), Pedrazzoni (I), Barbuti (S) and Baldini (P). **Behaviour of *Listeria monocytogenes* during the maturation of naturally and artificially contaminated salami: Effect of lactic bacteria starter cultures.** *International Journal of Food Microbiology* 20(3); 1993; 169-175

Results of this study indicated that, moderate *Listeria monocytogenes* growth in salami not inoculated with lactic acid bacteria after 7-14 days. The addition of starter cultures prevented growth, but not always the survival of *Listeria*. During the maturation of artificially-contaminated salami, *Listeria* counts tended to decrease, but no significant differences were observed between samples inoculated with *Lactobacillus plantarum* MCS or with MCSI bacteriocin-negative mutant strain. At the end of the maturation period, naturally-contaminated salami, differences in the survival of *Listeria* were observed in the batches inoculated with lactic-acid bacteria. *Listeria* appeared to be absent in salami inoculated with *L. plantarum* MCS strain. SRA

## Salmonella

1877

Warburton (DW), Harwig (J) and Bowen (B). **The survival of salmonellae in homemade chocolate and egg liqueur.** *Food Microbiology* 10(5); 1993; 405-410

Liqueurs with pooled cultures of salmonellae, stored at 4 and 22°C survived for more than 4 days. Subsequently, salmonellae survival was prevented by blending the eggs and the alcohol mixture then storing this mixture at room temp. for a min. of 15 min. Recommendations are suggested to ensure production of a safe product. SRA

1878

Krusell (L) and Skovgaard (N). **Evaluation of a new semi-automated screening method for the detection of Salmonella in foods within 24 h.** *International Journal of Food Microbiology* 20(3); 1993; 123-130

The detection of *Salmonella* in a var. of 161 foods and 9 animal feed samples were evaluated using the Eia Foss *Salmonella* method (ESM) in comparison with the Rappaport Vassiliadis cultural procedure (RVCP). Visible *Salmonella* were recovered in 30 samples using either method. When using ESM, 13% more samples were proved *Salmonella* positive compared with the reference method. SRA

## Staphylococcus aureus

1879

Wilson (IG), Gilmour (A), Cooper (JE), Bjourson (AJ) and Harvey (J). **A non-isotopic DNA hybridisation assay for the identification of Staphylococcus aureus isolated from foods.** *International Journal of Food Microbiology* 22(1); 1994; 43-54

A digoxigenin - labelled total genomic DNA probe was used to identify *Staphylococcus* in < 2 days compared to 5 days by multipoint inoculation. The probe showed excellent discrimination of *Stap. aureus* from other staphylococci and from a wide range of bacteria commonly associated with milk and meat. The

probe gave comparable results to the conventional methods and, for large sample numbers, offered lower cost and greater ease of use. SRA

## Fungi

1880

Venkateshwarlu (N) and Reddy (SM). **Production of lipase by five thermophilic fungi.** *Indian Journal of Microbiology* 33(2); 1993; 119-124

Production of lipase by *Emericella rugulosa*, *Hemicola* sp., *Thermomyces lanuginosus*, *Penicillium purpurogenum* and *Chrysosporium sulfureum* in 5 synthetic media was investigated. *E. rugulosa* and *T. lanuginosus* were efficient producers of lipase. Increased production of lipase in yeast extract medium suggested the adaptive nature of lipase in yeast extract medium suggested the adaptive nature of lipase secreted by all the fungi. The optimum conditions for lipase activity were pH 8.0, temp. 45 C, a substrate enzyme - ratio of 0.9:1.1 and 3 h of incubation time for all the fungi. AA

## Aspergillus oryzae

1881

Kudo (K), Okoshi (A), Usami (R) and Horikoshi (K). **Cloning an autonomous replication sequence from Aspergillus oryzae.** *Starch/Staerke* 45(6); 1993; 209-211

A DNA sequence from the genome of *Aspergillus oryzae* [IAM 2651] is described; the sequence allows the hybrid plasmid, pOK-1 to replicate autonomously in *Saccharomyces cerevisiae*. Plasmid pOK-1 was constructed from pBR325 and YEpl3 fragments containing the *Leu2+* gene. *A. oryzae* DNA and pOK-1 were cleaved with BamHI, ligated and introduced into *Escherichia coli*. Approx. 600 recombinant plasmids were obtained. One of the plasmids transformed *S. cerevisiae* SHY3 to *Leu2+*; the plasmid, designated pSB1-2, contained 2 BamHI fragments (4.3 and 4.1 kb) of *A. oryzae* DNA. AA

## BIOTECHNOLOGY

Nil

## TISSUE CULTURE

Nil

## FOOD ADDITIVES

### Antioxidants

1882

Mallet (JF), Cerrati (C), Ucciani (E), Gamisans (J) and Gruber (M). **Antioxidant activity of plant leaves in relation to their  $\alpha$ -tocopherol content.** *Food Chemistry* 49(1); 1994; 61-65

The leaf  $\alpha$ -tocopherol content of 15 plant sp. was determined by a GC method with  $\alpha$ -tocopherol acetate used as internal standard. Highest amounts were found in leaves of *Pelargonium* sp. (412 p.p.m.) and *Thalictrum flavum* (371 p.p.m.), which could represent an interesting source of  $\alpha$ -tocopherol for different purposes, such as stabilization of food products. Antioxidant activity of leaf extracts was evaluated spectrophotometrically by coupled oxidation of  $\beta$ -carotene and linoleic acid. The species could thus be ranked on the basis of an antioxidant-activity coeff. Correlation established between the  $\alpha$ -tocopherol content and antioxidant activity yielded a coeff. of 0.93 suggesting that  $\alpha$ -tocopherol is the major liposoluble antioxidant found in leaves. AA

## CEREALS

1883

Landry (J) and Delhay (S). **The tryptophan contents of wheat, maize and barley grains as a function of nitrogen content.** *Journal of Cereal Science* 18(3); 1993; 259-266

Tryptophan contents of wheat, corn and barley cv. were determined; the grains were selected to cover a wide range of N contents or because they had the same N content. 58 samples of winter wheats (*Triticum aestivum*) and 9 samples of durum wheat (*Triticum durum*) representing commercial cv., 40 samples of corn representing commercial and experimental cv. and 20 samples of barley representing experimental cv. were used. A linear relationship was found between level of tryptophan and N content for each of the grain samples. Results show that the calculation of tryptophan content from literature equations underestimates tryptophan levels by 10 plus/minus 5%; great variability in tryptophan content for any given grain N content is revealed. BV

### Oat

1884

Virtanen (T), Autio (K), Suortti (T) and Poutanen (K). **Heat-induced changes in native and acid-modified oat starch pastes.** *Journal of Cereal Science* 17(2); 1993; 137-145

Storage and cooling effect on the microstructure of native and acid-modified oat starch (AMOS) pastes was studied using light microscopy and viscoelastic measurements, with special reference to heat treatment. Between 90 and 95°C, the oat starch granule structure broke down; at 95°C, the amylopectin formed a continuous phase in which amylose was dispersed. During cooling of oat dispersions preheated to 95 and 98°C, 2 transitions in viscoelastic behaviour were observed, one below 85°C and the other below 40°C; the former transition is related to phase separation of amylose and amylopectin and the latter transition is related to aggregation of amylose. Separation into amylose- and amylopectin-rich domains was enhanced by cooling and storage at 4°C. Preheating to 95°C caused most of the acid-modified oat starch to be solubilized; viscosity of the hot paste was lower than that of native oat starch dispersions. AMOS underwent a transition in viscoelastic behaviour when cooled: below 40°C, storage modulus increased and phase angle decreased. Amylose was found to be responsible for the gel structure of the AMOS. BV

## Rice

1885

Rao (KS), Moorthy (BTS), Lodh (SB) and Sahoo (K). **Effect of graded levels of nitrogen on yield and quality of different varieties of scented rice (*Oryza sativa*) in coastal Orissa.** *Indian Journal of Agricultural Sciences* 63(8); 1993; 467-472

Rice var. Basmati 370, Pakistan Basmathi, Kasturi, IET 8579, Ranbir Basmati and Badshahbhog were grown in wet seasons of 1988 and 1989 and dry seasons of 1988-90 by applying 30, 60 or 90 kg/ha of N. Alkali value, vol. expansion and water uptake of the grains were not affected by N application. Higher N application (60 or 90 kg/ha) reduced the head-rice recovery by 3.2-8.8% and increased the amylose content by 3.0-9.9% in Kasturi, IET 8579, Ranbir Basmati and Basmati 370 but Badshahbhog was not affected by N application. KAR

1886

Casiraghi (MC), Brighenti (F), Pellegrini (N), Leopardi (E) and Testolin (G). **Effect of processing on rice starch digestibility evaluated by *in vivo* and *in vitro* methods.** *Journal of Cereal Science* 17(2); 1993; 147-156

An Italian var. of rice (*Fino Ribe*) was industrially processed in 3 different ways (polished, parboiled (PR) and quick-cooking parboiled (QCPR)) and then tested for *in vitro* and *in vivo* starch digestibility. Samples were digested *in vitro* with pepsin and pancreatic  $\alpha$ -amylase. Percentages of starch digested were lower ( $p < 0.05$ ) in PR and QCPR than in polished rice. The breath  $H_2$  test and the glycaemic index (GI) technique were used to evaluate completeness of starch digestion *in vivo* and glycaemic response. Both the PR and QCPR had a lower ( $p < 0.05$ ) GI than polished rice, but there was no evidence of the presence of higher amounts of malabsorbed starch. BV

## Wheat

1887

Lang (W) and Sokhansanj (S). **Bulk volume shrinkage during drying of wheat and**

**canola.** *Journal of Food Process Engineering* 16(4); 1993; 305-314

Bulk vol. (BV) shrinkage of canola and wheat were measured for the temp. range of 20-80°C and RH 15-90%. BV decreased exponentially with time as seed moisture content was reduced. For canola, an oilseed, shrinkage and moisture reduction were linearly correlated with a shrinkage coeff. of about 1.0. For wheat, a starchy grain, the relationship was also linear but the coeff. was  $> 1.3$ . The shrinkage coeff. for both wheat and canola did not show a correlation with drying temp. but varied linearly with RH of the drying air. BV

1888

Crosbie (GB) and Lambe (WJ). **The application of the flour swelling volume test for potential noodle quality to wheat breeding lines affected by sprouting.** *Journal of Cereal Science* 18(3); 1993; 267-276

Three experiments were undertaken (i) to determine effective inactivation treatments for field-sprouted grain; (ii) the adequacy of selected inactivation treatments on laboratory-sprouted samples that covered a wide range of  $\alpha$ -amylase activities; (iii) examination of the relationship between flour swelling vol. (FSV) test data, derived from sprouted grain, with inactivation, and subjective assessments of the texture of boiled noodles from corresponding samples of sound wheat. The FSV test was unaffected by low levels of  $\alpha$ -amylase; no special inactivation treatment was needed for slightly sprouted wheat. FSV results were greatly affected when using severely sprouted wheat, and an inactivation treatment was required. Treatments using 0.5mM  $AgNO_3$  and 0.1M HCl were compared; the former was found to be the more effective. When this treatment was applied to severely sprouted grain, FSV results were highly correlated with eating quality of boiled noodles derived from the sound wheat. BV

1889

Randall (PG), Manley (M), McGill (AEJ) and Taylor (JRN). **Relationship between high Mr subunits of glutenin of South African wheats**

**and end-use quality.** *Journal of Cereal Science* 18(3); 1993; 251-258

1890

Every (D). **Purification and characterization of a glutenin hydrolysing proteinase from wheat damaged by the New Zealand wheat bug, *Nysius huttoni*.** *Journal of Cereal Science* 18(3); 1993; 239-250

1891

Gan (Z), Ellis (PR) and Schofield (JD). **Antisera against wheat diacylgalactosylglycerol (MGDG) and diacyldigalactosylglycerol (DGDG).** *Journal of Cereal Science* 18(3); 1993; 207-210

1892

Kovacs (MIP), Howes (NK), Leisle (D) and Skerritt (JH). **The effect of high Mr glutenin subunit composition on the results from tests used to predict durum wheat quality.** *Journal of Cereal Science* 18(1); 1993; 43-51

Relationships between protein content, mixograph mixing development time (MDT), SDS sedimentation vol. (SV), cooked gluten viscoelasticity (CGV) and pasta disc viscoelasticity (PDE) were investigated, and effects of  $\gamma$ -gliadins 42 or 45 and of high mol. wt. glutenin subunits 6 + 8 or 20 on these quality parameters were determined. Progeny from a cross in which both parents (Vic and Berillo) had low mol. wt. glutenin subunit 2 were used in order to eliminate the influence of low mol. wt. glutenin subunit variation. Usefulness of monoclonal antibody 304/13 to distinguish between durum wheat lines having high mol. wt. glutenin subunits 6 + 8 or 20 was investigated because it was specific for chromosome 1B high mol. wt. glutenin subunits under the assay conditions used. Vic and Berillo gave high CGV and PDV values; Vic also had high SV and MDT values, whilst those for Berillo were relatively low. Significantly higher SV values were found for lines having high mol. wt. glutenin subunits 6 + 8 than for those having high mol. wt. glutenin subunits 20. Results indicate that, while both SV and CGV predict gluten strength, they are independent quality characteristics. Breeders' lines containing high mol. wt. glutenin

subunits 6 + 8 or 20 could be identified by monoclonal antibody clone 304/13. AA

1893

Gupta (RB), Khan (K) and Macritchie (F). **Biochemical basis of flour properties in bread wheats. I. Effects of variation in the quantity and size distribution of polymeric protein.** *Journal of Cereal Science* 18(1); 1993; 23-41

Relationships between total polymeric protein (PP) and wheat flour properties were studied by size-exclusion HPLC (SE-HPLC) using 3 genetically diverse sets of wheat lines/cv., 2 of which were grown at 2 different locations. Size distribution of the PP was determined in the 3 sets of wheat genotypes using an indirect procedure based on the inverse relationship between extractability and molecular size. The total PP, based on its extractability in 0.5% SDS buffer without sonication, is separated into 2 size groups (extractable and unextractable). The unextractable PP is then solubilized by sonication and quantified by SE-HPLC and the % of unextractable PP in the total PP or in total protein (TP) is used as a measure of protein size distribution. % of total PP showed variable relationships with flour properties, particularly dough strength. Portion of the total PP extractable in SDS was positively correlated with dough strength properties in each of the sets. SE-HPLC showed that the unextractable PP contained a significantly greater proportion of larger polymers than its extractable counterpart. The unextractable fraction had a significantly higher ratio of high mol. wt. to low mol. wt. glutenin subunits than the extractable fraction, suggesting that the molecular size distribution is shifted to higher molecular sizes as this ratio increases. Since the measurements of the relative size distributions of PP or TP also showed wide genetic variance, and were independent of growth environment, they provide a reliable biochemical criterion for predicting dough strength of wheat. BV

1894

Blumenthal (CS), Barlow (EWR) and Wrigley (CW). **Growth environment and wheat quality: the effect of heat stress on dough properties and gluten proteins.** *Journal of Cereal Science* 18(1); 1993; 3-21

The effects of wheat growth environment, especially heat stress, on dough properties and gluten proteins are reviewed. A better understanding of the effects of growth conditions would aid interpretation of cv. trials, prediction of cv. performance in commercial processing and improve the segregation and marketing of wheat harvests. Aspects considered include: segregation for quality type; temperature during grain filling and dough properties; analysis of crop statistics (prevalence of high-temperature stress); analysis of cultivar trial data; field studies of heat stress; gluten composition after heat stress (glasshouse experiments); the heat-shock response; synthesis of a gliadin-like peptide under heat stress (location of the gene coding for the heat-induced peptide); gliadins as heat-shock proteins; providing heat tolerance; and prediction of heat-associated quality changes. 44 references. BV

1895

Preston (KR) and Symons (SJ). **Measurement of heat damage in wheat by assessment of protein fibril formation.** *Journal of Cereal Science* 18(1); 1993; 53-59

Effects of heat treatment of wheat on protein fibril formation were investigated. Preliminary studies showed that heat treatment could reduce or eliminate the ability of endosperm tissue to form fibrils upon wetting. A fast and simple microscopic screening test was developed to assess the presence of heat damage in wheat. 3 samples of Canada Western Red spring and 2 samples of Canada Prairie Spring wheat were heat treated at 65 and 70°C for 0, 2, 4, 8 and 16 h to obtain a range of heat damage, as determined by changes in physical dough properties. Samples that displayed normal dough properties following heat treatment showed extensive fibril formation, samples that were rated as damaged showed little or no fibril formation, and samples rated as seriously reduced in quality showed a reduction in degree of fibril formation. BV

1896

Andersson (R), Westerlund (E), Tilly (AC) and Aman (P). **Natural variations in the chemical composition of white flour.** *Journal of Cereal Science* 17(2); 1993; 183-189

The natural variation in chemical composition (starch, crude protein, ash and dietary fibre) of spring (SWF) and winter wheat flours (WWF) were evaluated with multivariate methods as well as traditional statistical procedures. Variation in the content of non-starch polysaccharides was studied using principle component analysis. Contents of starch, crude protein, ash and dietary fibre were (%) 74-86, 9-18, 0.5-0.7 and 2.7-4.7, respectively. SWF had, on average, a higher content of non-starch polysaccharides than WWF; differences in the proportions of soluble and insoluble non-starch polysaccharides were related to yr of harvest. BV

1897

Oliver (JR), Blakeney (AB) and Allen (HM). **The colour of flour streams as related to ash and pigment contents.** *Journal of Cereal Science* 17(2); 1993; 169-182

Colours of 4 flours milled from white spring wheats of different hardness (2 hard and 2 soft) were examined. The relationship of flour colour (FC) to flour ash (FA) content, yellow pigment (YP) content and grade value was also investigated. Objective measurements of perceived colours of streams were obtained in terms of CIELAB colour space parameters.  $L^*$  was correlated with FA content,  $b^*$  with flour YP content, and FC index ( $L^* - b^*$ ) with both ash and YP. BV

1898

Graybosch (RA), Peterson (CJ), Hansen (LE), Worrall (D), Shelton (DR), Lukaszewski (A). **Comparative flour quality and protein characteristics of 1BL/1RS and 1AL/1RS wheat-rye translocation lines.** *Journal of Cereal Science* 17(2); 1993; 95-106

1899

Masoje (P), Zawistowski (J), Zawistowska (U) and Howes (NK). **A combined monoclonal and polyclonal antibody sandwich ELISA for quantification of the endogenous  $\alpha$ -amylase inhibitor in barley and wheat.** *Journal of Cereal Science* 17(2); 1993; 115-124

## MILLETS

1900

Jayachandra (K) and Azeemoddin (G). **Common millet (*Panicum milliaceum*) bran: A potential source of oil.** *Journal of the Oil Technologists Association of India* 26(3); 1994; 73-74

The bran of *Panicum milliaceum* millet resembles rice bran in appearance and its yield is about 15% on the wt. of whole grain during milling. The bran contains 16-20% oil which is light yellow in colour and semi dry in nature. AA

## Barley

1901

Wrobel (R) and Jones (BL). **Identification and partial characterization of high  $M_r$  neutral proteinases from 4-day germinated barley seed.** *Journal of Cereal Science* 18(3); 1993; 225-237

1902

Manzanares (P), Navarro (A), Sendra (JM) and Carbonell (JV). **Determination of the average molecular weight of barley  $\beta$ -glucan within the range 30-100k by the Calcofluor-FIA method.** *Journal of Cereal Science* 18(3); 1993; 211-223

1903

Molina-Cano (JL), Royo (C), Rubio (A), Vendrell (PA), Swanston (JS), Ellis (RP). **Hot water extracts in a mutant derived from the barley cultivar Troubadour.** *Journal of Cereal Science* 18(1); 1993; 69-74

The mutant barley genotype TR49 and the cv. from which it was derived (Troubadour) were grown at 4 sites throughout Spain in 1989 and 1990. Significant differences due to genotype and environment were detected for malting quality parameters in 1990. Hot water extract was correlated with factors involved with endosperm structure ( $\beta$ -glucan content, malt protein and Kolbach index).  $\alpha$ -Amylase and  $\beta$ -glucanase levels were not significantly different in extract, although levels were

significantly different between genotypes. Results indicated that TR49 has the genetic potential to give levels of extract in excess of those produced by the parent cv. This may be due to the differences in the structure and chemical composition of the endosperm cell walls, which facilitate modification. These differences are, however, subject to genotype-environment as well as genotypic variation, so the advantage of TR49 over Troubadour may not always be expressed. BV

1904

MacNicol (PK), Jacobsen (JV), Keys (MM) and Stuart (IM). **Effects of heat and water stress on malt quality and grain parameters of Schooner barley grown in cabinets.** *Journal of Cereal Science* 18(1); 1993; 61-68

Heat and water stresses were separately applied 17 or 27 days post anthesis. Mature grain was then micromalted and malting quality was measured. Water stress at 17 days post anthesis caused grain (13),(14)-beta-glucan levels to decrease and malt extract, (13),(14)- $\beta$ -glucanase,  $\alpha$ -amylase and  $\beta$ -amylase levels to increase. At 27 days post anthesis, only malt extract levels increased. Heat stress had no effect on these parameters. Yield and grain size were reduced by both types of stress. Results suggest that malting performance is more related to water stress than heat stress. It is concluded that a limited episode of water stress during grain-fill may aid malting quality. BV

1905

Lauro (M), Suortti (T), Autio (K), Linko (P) and Poutanen (K). **Accessibility of barley starch granules to alpha-amylase during different phases of gelatinization.** *Journal of Cereal Science* 17(2); 1993; 125-136

The effect of the degree of gelatinization of barley starch (BS) granules on their accessibility to  $\alpha$ -amylolysis was studied, and the subsequent changes in starch properties were monitored. *Bacillus licheniformis* and porcine pancreatic  $\alpha$ -amylases had only limited ability to hydrolyse raw BS during  $\alpha$ -amylolysis at 30°C. Annealing of starch for 3 h at < 50°C did not increase enzyme accessibility. At pre-heating temp. of 55 and 60°C,  $\alpha$ -amylase

treatment at 30°C produced an increased amount of solubilized carbohydrates, indicating an increase in enzymic accessibility. Reduced order and crystallinity of the starch, as detected by thermal analysis, could explain the increase in enzyme accessibility. After pre-heating at greater than or equal to 50°C, changes were observed in the molecular size distribution of  $\alpha$ -amylase-treated BS granules. BV

## Corn

1906

Hounhouigan (DJ), Nout (MJR), Nago (CM), Houben (JH) and Rombouts (FM). **Characterization and frequency distribution of species of lactic acid bacteria involved in the processing of mawe, a fermented maize dough from Benin.** *International Journal of Food Microbiology* 18(4); 1993; 279-287

Lactic acid bacteria involved in the natural fermentation of both home-produced and commercial mawe were investigated during a 72 h fermentation period. *Lactobacillus* spp. constitute the majority (94%) of the strains of the lactic acid bacteria isolated, among which 89% represent the Betabacterium group. They include *L. fermentum* (biotype *cellobiosus*) (41%), *L. fermentum* or *L. reuteri* (19%), *L. brevis* (26%), *L. confusus* (< 2%), *L. curvatus* (< 1%) and *L. buchneri* (< 1%). Other isolated lactic acid bacteria were *L. salivarius*, *Lactococcus lactis*, *Pediococcus pentosaceus*, *Pediococcus acidilactici* and *Leuconostoc mesenteroides*. Several species were detected at the early stage of fermentation, but the final stage was dominated by *L. fermentum* (biotype *cellobiosus*) and *L. fermentum* or *L. reuteri* totalling 90% of the isolated strains. The trend was the same for both home-produced and commercial mawe. No strains of *L. plantarum*, generally reported as dominating lactic acid bacteria at the final stage of fermentation of most plant foods, were isolated. AA

1907

Chamberlain (WJ), Bacon (CW), Norred (WP) and Voss (KA). **Levels of fumonisin B<sub>1</sub> in corn naturally contaminated with aflatoxins.** *Food and Chemical Toxicology* 31(12); 1993; 995-998

Twenty eight samples of maize were assayed for total aflatoxin and fumonisin B<sub>1</sub>. 27 were positive for aflatoxin, 24 for fumonisin B<sub>1</sub> and 23 had detectable levels of both. The mean aflatoxin concn. was 73 p.p.b (SD = 86) and the average fumonisin B<sub>1</sub> concn. was 0.87 p.p.m. (SD = 0.65). GS

1908

Arasaratnam (V) and Balasubramaniam (K). **Synergistic action of  $\alpha$ -amylase and glucoamylase on raw corn.** *Starch/Staerke* 45(6); 1993; 231-233

Optimum ratio of glucoamylase to  $\alpha$ -amylase for synergistic hydrolysis of starch in corn flour was 1.8 AGU:1.0 KNU (AGU = Amyloglucosidase Unit; KNU = Kilo Novo Unit). The rate of hydrolysis of starch in dry milled corn was faster than that of waxy maize starch and wet processed corn. Hydrolysis of starch in dry milled corn was most efficient compared with that of wet milled corn steeped in water or NaOH. AA

1909

Cura (JA), Tolmasky (DS), Reid (A), Salerno (JC) and Krisman (CR).  **$\alpha$  1,4- $\alpha$  1,6 glucopolysaccharides contained in developing maize kernels.** *Starch/Staerke* 45(6); 1993; 206-209

Corn kernels with different ripening times were fractionated to determine the  $\alpha$ -1,4/ $\alpha$ -1,6-glucopolysaccharide composition and structure. Sugary (SU), waxy, flint and several hybrids were analysed. Total content of polysaccharides increased as kernels ripened. No differences in composition and structure were detected between the 1st (15th day after pollination) and the last samples analysed, corresponding to the entire ripening period. Introduction of the SU character into hybrids (F x S and S x F) influenced final polysaccharide structure. Also, structural characteristics of F x W hybrid  $\alpha$ -1,4/ $\alpha$ -1,6-glucans were different from those of pure F or W. BV

1910

Pagano (EA) and Krisman (CR). **Endosperm  $\alpha$  1,4- $\alpha$  1,6 glucopolysaccharides utilization during germination of sweet corn and other**

**maize genotypes.** *Starch/Staerke* 45(6); 1993; 203-205

The quality variations and structural changes of  $\alpha$ -1,4/ $\alpha$ -1,6-glucopolysaccharides in the endosperm of sweet corn, waxy and amylose extender maize genotypes were studied during early germination.  $\alpha$ -1,4/ $\alpha$ -1,6- Gluco polysaccharides were fractionated according to the degree of branching. The results showed that the degradation pattern of  $\alpha$ -1,4- $\alpha$ /1,6-glucopolysaccharides was similar for the different corn genotypes studied. Soluble dextrans or partial degradation products were not detected but reducing sugars were accumulated. The structure of the remaining polysaccharides was similar to that of those present in the non-germinating seed. It is concluded that once a polysaccharide molecule is used as substrate by degradative enzymes during germination, that molecule is totally degraded. AA

1911

Keshinro (OO), Ogundipe (AO), Emuakpor (SMM) and Egele (PU). **Effects of preparatory procedures on selected nutrient contents of some tropical maize products.** *Journal of Cereal Science* 18(3); 1993; 287-294

Changes in nutrients composition of corn-based foods (CFs) (commonly eaten in Nigeria during preparation was studied. Dry whole corn was used in the preparation of tanfirin, eko/agidi, Tom Brown, guguru, egbo and ogi/akamu, while fresh corn was used in the preparation of kongo, boiled corn-on-the-cob and roasted corn-on-the-cob. Preparation techniques involved soaking, wet milling and sieving. All of the products lost considerable amounts of nutrients during processing. Eko/agidi corn gel and ogi/akamu porridge especially lost large amounts of nutrients. Ogi/akamu lost all of its fat and Fe content; eko/agidi corn gel retained some fat, but its value was significantly lower than that for raw dry corn. Eko/agidi also lost all of its Fe. Nutrients composition of kongo and Tom Brown improved as a result of incorporation of shrimps, milk or sugar. Protein levels in kongo improved by about 31.2% on processing, and oil values improved by 65.3%; Ca levels increased 2-fold. Similarly, Tom Brown increased in fat and proteins values by 32.7

and 43.7%, respectively. The energy value of tanfirin increased by 16.2%. Results indicate that soaking, wet milling and sieving methods for the preparation of CFs should be discouraged. Consumption of foods such as kongo and Tom Brown should be encouraged in view of their increased nutritional value. New corn-based recipes, particularly those containing ingredients additional to corn, would be advantageous not only for improving nutrient content but also to introduce variety into corn-based diets. BV

### Pearl millet

1912

Kishore (N), Lohan (OP), Chahal (SM) and Rathee (CS). **Effect of various processing techniques on the nutritive value and digestibility of pearl millet (*Pennisetum typhoideum*).** *Indian Journal of Animal Science* 63(1); 1993; 66-70

Experiment 1 was conducted to study the effect of processing (grinding, intact grain reconstitution, ground grain reconstitution and grain reconstituted and then ground) on *in-sacco* dry-matter digestibility and available carbohydrates in pearl millet ('HHB-67', *pennisetum typhoideum*), sorghum white ('HC-136', *Sorghum bicolor*) and sorghum red (JS-20, *Sorghum bicolor*). Processing increased *in-sacco* dry-matter digestibility, available total sugars and maltose in millets. In experiment 2, diets containing pearl millet ground (T<sub>1</sub>), a pearl millet soaked (T<sub>2</sub>), pearl millet cooked (T<sub>3</sub>), pearl millet reconstituted (T<sub>4</sub>), and pearl millet ground, and then reconstituted (T<sub>5</sub>), were fed to fistulated male buffaloes with wheat straw *ad lib.* to all animals. The DM, OMm, CP and NFE digestibilities were significantly ( $P < 0.05$ ) higher than T<sub>3</sub> as compared to other treatments except T<sub>3</sub>. The CF digestibility was significantly ( $P < 0.05$ ) higher in T<sub>2</sub> and T<sub>4</sub> than T<sub>1</sub>, T<sub>3</sub> and T<sub>5</sub>. The DCP and TDN values were significantly higher in T<sub>5</sub> than in other treatments. Reconstituted pearl millet had higher DCP and TDN values than other processing forms (by difference). The concn. of NH<sub>3</sub>-N in SRL was max. at 2 h post-feeding, being highest in T<sub>5</sub>. TVFA production was less in T<sub>4</sub> than in other treatments. AA

## PULSES

### Cowpeas

1913

Tarsem Lal and Surjan Singh. **'Cowpea 263' is a dual-season vegetable.** *Indian Horticulture* 37(4); 1993; 18-20

'Cowpea 263' (*Vigna unguiculata*) grown in rainy and spring seasons is dwarf with medium green pods which is thick, meaty, tender and about 20 cm long. Av. green pod yield is 8.4-9.0 t/ha. Pods have 10.9% DM content and 3.57% crude protein. It is superior in yield and built in ability to overcome the incidence of mosaic virus to greater extent than the existing 'Pusa', 'Dofasli', 'Pusa Komal' and 'Pusa Bersati', var. SRA

### Peas

1914

Dhillon (GS) and Mohan Singh. **'Mattar Ageta 6': and early- and high-yielding garden pea.** *Indian Horticulture* 37(4); 1993; 16-17

New pea var. 'Mattar Ageta 6' is an improvement over early maturing popular Punjab var. 'Arkel' and 'Harabona'. It can be planted as early as 'Harabona'. Yield of 'Mattar Ageta 6' is 4.8 t/ha and that of 'Harabona' and 'Arkel' 2 and 3 t/ha respectively. 48% of the first-picking may be done in 47 days in the new var. but only 11 and 26% for 'Harabona' and 'Arkel' after 57 and 52 days respectively. SRA

1915

Bertoft (E), Manelius (R) and Zhu (Q). **Studies on the structure of pea starches. I. Initial stages in  $\alpha$ -amylolysis of granular smooth pea starch.** *Starch/Staerke* 45(7); 1993; 215-220

Hydrolysis of pea starch granules was investigated. A diluted solution of *Bacillus amyloliquefaciens*  $\alpha$ -amylase (EC 3.2.1.1) was pumped through a layer of smooth pea starch granules in a column and further into an ion exchanger that retained the enzyme but not the solubilized dextrans; experimental design prevented secondary hydrolysis of the

solubilized dextrans. Granules were resistant to hydrolysis by  $\alpha$ -amylase; dextrans from the initial stages of solubilization of both large and small granules had a d.p. (degree of polymerization) of 2-100. Large granules (15-30  $\mu$ m) that were treated with a more conc. enzyme solution in a test-tube were solubilized up to 7%. Granular residues contained increased amounts of dextrans in the d.p. range 50-300. SEM revealed extensive fragmentation of granules; the enzyme had preferentially attacked starch in layers between 'growth rings'. AA

## OILSEEDS AND NUTS

### Groundnuts

1916

Ellis (WO), Smith (TP), Simpson (BK), Ramaswamy (H) and Doyon (G). **Growth of and aflatoxin production by *aspergillus flavus* in peanuts stored under modified atmosphere packaging (MAP) conditions.** *International Journal of Food Microbiology* 22(2/3); 1994; 173-187

The combined effects of  $a_w$ , storage temp. and headspace oxygen (HSO) over a 3 wk period on the growth of, and aflatoxin production, by *Aspergillus flavus* on sterile peanuts packaged in a high gas barrier films showed slight to extensive mold growth during 1st wk of storage. Max. growth occurred in peanuts with an  $a_w$  of 0.97, storage temp. of 25 C and 10% of HSO, after 21 days of storage while max. aflatoxin production occurred at a lower  $a_w$  of 0.94, after 21 days under similar conditions. Study also indicated that *Asp. flavus* can grow and produce aflatoxin in CO<sub>2</sub> enriched atm. in the presence of O<sub>2</sub>. Study emphasizes the combined effect of several 'barriers' to inhibit and reduce aflatoxin in modified atm. packaged products containing various levels of residual O<sub>2</sub>. SRA

### Sesame

1917

Suryavanshi (GB), Pawar (VS), Umrani (NK) and Ransing (SK). **Effect of sowing date on yield and quality of sesame (*Sesamum***

*indicum*) varieties. *Indian Journal of Agricultural Sciences* 63(8); 1993; 496-498

Sesame var. JLT 7, Hawari, Phule Til 1, TC 25 and L 38 were sown in 1987 on 10th, 25th June and 10th and 25th July 1987. Significant varietal differences were noted in oil content but not in protein content. Early sowing increased the content of seeds. Delayed sowing improved the protein content. KAR

## Soybeans

### Soy products

#### Soy sauce

1918

Uchida (K) and Kanbe (C). **Occurrence of bacteriophages lytic for *Pediococcus halophilus*, a halophilic lactic acid bacterium, in soy sauce fermentation.** *Journal of General and Applied Microbiology* 39(4); 1993; 429-437

Bacteriophages specific for *Pediococcus halophilus*, a group of halophilic lactic cocci used as starters for soy sauce fermentation, were isolated from fermenting soy sauce moromi-mash. Typical two of these phages,  $\phi$ 7116 and  $\phi$ D-86, which propagate on *P. halophilus* NISL 7116 and D-86 respectively, were purified and studied for their morphology and some infecting properties. Morphotype of  $\phi$ 7116 was Ackermann's A1 having an isometric head of 87-96 nm diam. and a contractile tail of 200 nm, length,  $\phi$ D-86 was found to be morphotype B1, having a 67 nm isometric head and a 300 nm noncontractile tail. Both the phages could propagate on their each host under any pH or salt conditions in which their hosts could grow. Latent periods were both 5 h and burst sizes were 27-28. Their host ranges were substantially strain-specific. They both thermally inactivated at 60 C. Stable pH ranges for  $\phi$ 7116 and  $\phi$ D-86 were 5.0-8.8 and 4.4-10.7 respectively. In diluted NaCl sol.,  $\phi$ D-86 was fairly stable over 0.03-2.6 M but  $\phi$ 7116 was unstable specifically between 0.04-0.1 M. AA

#### Tempe

1919

Denter (J) and Bisping (B). **Formation of B-vitamins by bacteria during the soaking process of soybeans for tempe fermentation.** *International Journal of Food Microbiology* 22(1); 1994; 23-31

Investigation was carried out to study the influence of selected bacteria on the formation of B-vitamins (nicotinic acid, nicotinamide, thiamine, vitamin B<sub>6</sub> and vitamin B<sub>12</sub>) during the soaking stage of soybeans for the tempe fermentation. Among the isolates examined no vitamin B<sub>6</sub> producer was found. After inoculation of the soaking soybeans with *Citrobacter freundii*, *Klebsiella pneumoniae*, *Pseudomonas fluorescens* and *Streptococcus* spp. The concn. of vitamin B<sub>12</sub> increased significantly. Soakings inoculated with *C. freundii* showed an increased vitamin B<sub>12</sub> content. SRA

#### Sunflower seeds

1920

Mazza (G) and Gao (L). **Malonylated anthocyanins in purple sunflower seeds.** *Phytochemistry* 35(1); 1994; 237-239

The anthocyanin pigments (cyanidin 3-glucoside, cyanidin 3-malonylglucoside, cyanidin 3-xyloside and cyanidin 3-malonylxyloside) were identified in the hulls of purple sunflower seeds by chromatographic spectral and chemical properties. Depending on the cv, a dark red product was obtained when the oilcake was extracted with acidified aqueous ethanol and the extract concentrated. This product can be used to colour food, pharmaceutical and cosmetic products. BV

## TUBERS AND VEGETABLES

### Root vegetables

#### Carrot

1921

Chakkaravarthi (A), Math (RG), Walde (SG) and Rao (DG). **Grinding characteristics of carrots (*Daucus carota* L.).** *Journal of Food Engineering* 20(4); 1993; 381-389

Grinding characteristics of carrots (*D. carots* L.) in the form of grits were studied in a hammer mill. The grits were first dried to different moisture contents, before being ground to a powder; energy required for grinding was noted. Kick's law, Rittenger's law and Bond's law were applied to the grinding process, and the constants of these various laws were found. The moisture content of dried grits had a significant effect on grinding energy, which increased as moisture content increased from 10 to 15%, decreased as moisture content rose to 18% and, again, increased as moisture content rose to higher values. A moisture content of 18%, therefore, could be recommended for grinding operations as it requires the least grinding energy. AA

### Radish

1922

Tamang (JP) and Sarkar (PB). **Sinki: a traditional lactic acid fermented radish tap root product.** *Journal of General and Applied Microbiology* 39(4); 1993; 395-408

Sinki, a non-salted fermented radish tap root product, is traditionally consumed as a base for soup and as a pickle in some north-eastern states of India, in Nepal and a few places of Bhutan. A total of 453 strains of lactic acid bacteria were isolated from 40 samples of sinki. They belonged to either *Lactobacillus plantarum* or *Lactobacillus brevis*. In the substrate, in addition to these two, *Lactobacillus fermentum* was present. Sinki was dominated by *L. plantarum* followed by *L. brevis*, with their prevalence in 100% of the samples. In order to study the changes in proximate and microbial composition accompanying fermentation, the process conditions for the production of sinki were optimized. Glass jar as a fermentation container and 12 days' fermentation at 30°C were found optimum. During fermentation under optimized conditions, the pH of the fermenting mass dropped from 6.7 to 3.3. This was due to an increase in titratable acidity from 0.04 to 1.28%. The fermentation was initiated by heterofermentative *L. fermentum*, followed by another heterofermentative *L. brevis*, and finally succeeded by homofermentative *L. plantarum*. AA

### Vegetables

1923

Wang (W-C) and Sastry (SK). **Salt diffusion into vegetable tissue as a pretreatment for ohmic heating: determination of parameters and mathematical model verification.** *Journal of Food Engineering* 20(4); 1993; 311-323

Diffusion coeff. (DC) and equilibrium distribution coeff. (EDC) were determined for infusion of salt sol. into potato tissue. Samples were infused with aqueous NaCl sol. of various concn., and concn. in solid and liquid were determined over time using titration methods. EDC distribution coeff. were dependent on salt concn. Values of DC [between  $3.1 \times 10^{-6}$  and  $5.3 \times 10^{-6} \text{ cm}^2/\text{s}$ ] were within the ranges reported in the literature. For the conditions studied, the DC was unaffected by brine concn. An analytical model for concn. profiles was in good agreement with experimental results. AA

1924

Kiranoudis (CT), Maroulis (ZB), Tsami (E) and Kouris (MD). **Equilibrium moisture content and heat of desorption of some vegetables.** *Journal of Food Engineering* 20(1); 1993; 55-74

The equilibrium moisture content of potato, carrot, tomato, green pepper and onion was determined within 10-90%  $a_w$  at 30, 45 and 60°C using the standard static gravimetric method. The GAB [Guggenheim, Anderson and de Boer] equation was fitted to the experimental data using direct nonlinear regression analysis; agreement between experimental and calculated values was satisfactory. Net isosteric heat of desorption of water was determined from the equilibrium desorption data, using the Clausius-Clapeyron equation. An empirical exponential relationship between net isosteric heat of sorption and the moisture content was proposed and validated. BV

### Amaranthus

1925

Perez (E), Bahnassey (YA) and Breene (WM). **Some chemical, physical, and functional properties of native and modified starches**

of *Amaranthus hypochondriacus* and *Amaranthus cruentus*. *Starch/Staerke* 45(6); 1993; 215-220

Starch isolated from *A. hypochondriacus* and *A. cruentus* was chemically modified by cross-linking with phosphate. Native and modified starches from both species did not differ in crude protein or fat content and overall purity; starches contained approx. 90% amylopectin and 10% amylose. P and ash contents were highly correlated ( $r = 0.98$ ). Modification eliminated swelling power at 85°C and increased gelatinization temp. range, gel consistency, and peak and overall consistencies while decreasing resistance to mechanical breakdown, blue value and initial pasting temp. Modification effects were greater for *A. hypochondriacus* than for *A. cruentus* starch. Acidification to pH 4.5 decreased overall viscosity more in modified than in native forms. AA

1926

Perez (E), Bahnassey (YA) and Breene (WM). **A simple laboratory scale method for isolation of amaranth starch.** *Starch/Staerke* 45(6); 1993; 211-214

A new simple method was developed for isolating starch from seeds of *Amaranthus hypochondriacus* and *A. cruentus* and compared with 2 established methods. The method involves: steeping grains in 0.25% NaOH at 5°C for 24 h; blending; screening homogenate through increasingly finer sieves (80-, 200-, 270-mesh); centrifuging; suspending precipitated starch in water; neutralizing in 0.2N HCl; and air drying at room temp. for 2 days. Moisture content of starch produced by this method ranged from 97.9-98.9%. % Damaged starch was approx. 14. Reducing sugars were not detected; % amylose content was approx. 10. Temp. range of starch gelatinization was 70-93°C. The method is recommended for isolating amaranth starch for food uses on a laboratory scale. The method does not use the expensive, explosive, flammable and otherwise toxic and hazardous chemicals. BV

## Tomatoes

1927

Choudhury (B) and Tewari (RN). **Tomato 'Pusa Gaurav': an all purpose variety.** *Indian Horticulture* 37(4); 1993; 14-15

Indian Agricultural Research Institute, New Delhi, recently released tomato 'Pusa Gaurav' var. developed from exotic segregating generation of cross between 'Glamour' and 'Watch'. The plants are dwarf and bushy with moderate foliage cover. The fruits are smooth, elliptical and borne in clusters. They are suitable for processing and canning. It has 6% TSS and better keeping quality at room temp. SRA

## FRUITS

1928

El-Zoghbi (M). **Biochemical changes in some tropical fruits during ripening.** *Food Chemistry* 49(1); 1994; 33-37

Changes during ripening in alcohol-insoluble solids (AIS) and dietary fibres of mango, guava, date and strawberry as tropical fruit are described. The activities of various degradative enzymes in the fruits were also investigated. The results showed that the AIS and texture declined rapidly during ripening. The dietary fibres decreased as the fruits lost their firmness and became soft. Polygalacturonase and cellulase activities of the fruit tissues increased markedly during ripening in mango, guava and strawberry fruits. Both polygalacturonase and cellulase were absent or present at only a low level in the green date but displayed large increases in activity during ripening. The changes in polygalacturonase and cellulase activity were reflected in a reduction in fruit firmness and a decrease in anhydrogalacturonic acid and cellulose content during ripening. Pectinesterase activity decrease in mango, guava, and strawberry fruits during ripening, but its activity was increased in mango, guava, and strawberry fruits during ripening, but its activity was increased in date during ripening, although the degree of esterification of pectin decreased. AA

## Apples

1929

Elfving (DC) and Lougheed (EC). **Storage response of 'Empire' apples to benzyladenine and other chemical thinners.** *Journal of the American Society for Horticultural Science* 119(2); 1994; 253-257

In 3 trials over 3 yr, foliar benzyladenine (BA) application of fruitlet thinning of 'Empire' apple (*Malus domestica* Borkh) trees produced small and inconsistent effects on flesh firmness at harvest (H) and atm. storage (AS). Soluble solids concn. at H and AS were consistently increased by BA alone or together with gibberellins A<sub>4</sub> and A<sub>7</sub> (GA<sub>4+7</sub>) and were also increased by CB in one trial. Starch hydrolysis was slightly delayed by BA application. Ethylene evolution at H was increased by naphtheleneacetic acid (NAA) and slightly increased by PR treatments. Incidence of post harvest storage disorders was low and largely uninfluenced by thinning treatments. SRA

1930

Al Mashat (SHI) and Zuritz (CA). **Stress relaxation behavior of apple pomace and effect of temperature, pressing aid and compaction rate on juice yield.** *Journal of Food Engineering* 20(3); 1993; 247-266

Expression of juice from biological materials depends on many factors, e.g. permeability, compressibility and rheological properties of the biological material, which are influenced by product temp., addition of pressing aids and rate of compression. Expression of juice from apple pomace and subsequent relaxation was studied in an expression cell (0.1016 m diam., 0.254 m height) driven by an Instron universal testing machine under different constant displacement rates ( $2.117 \times 10^{-4}$ ,  $4.233 \times 10^{-4}$  and  $8.467 \times 10^{-4}$  m/s), temp. (8 and 21°C) and pressing aid concn. (with 1% and without rice hull). The behaviour of apple pomace under relaxation was characterized using 3-element generalized Maxwell models. The models predicted relaxation data with max. relative difference (MRD) less than or equal to 5%. Coeff. of detn. ( $r^2$ ) between the models and experimental data varied from 0.995 to 0.999. Apple temp., pressing aid concn. and

compression rates showed statistically significant effects on relaxation response. Juice yield increased with the addition of rice hull (up to 12%), decreasing temp. (up to 8%) and decreasing ram speed (up to 10%). This study provides a basis for determining the properties of apple pomace and may facilitate the design and operation of juice presses. AA

## Mangoes

1931

Yahia (EM) and Hernandez (MT). **Tolerance and responses of harvested mango to insecticidal low-oxygen atmospheres.** *Hortscience* 28(10); 1993; 1031-1033

'Keitt' mangoes (*Mangifera indica* L.) were stored for 0 to 5 days at 20°C in a continuous flow of an insecticidal low-O<sub>2</sub> atm. (0.2 to 0.3% balance N<sub>2</sub>). Fruit were evaluated every day after exposure to a low-O<sub>2</sub> atm. and again after being held in air at 20°C for 5 days. There was no fruit injury, organoleptic fruit quality was not lowered due to the low-O<sub>2</sub> atm., and fruit ripened normally. These results indicate that applying low-O<sub>2</sub> atm. postharvest can be used to control insects in mangoes. AA

## CONFECTIONERY, STARCH AND SUGAR

1932

Mazurkiewicz (J), Zaleska (H) and Zaplotny (J). **Studies in carbohydrate based glues and thickeners for foodstuffs. I. Glucose-sucrose-apple pectin ternary system.** *Starch/Staerke* 45(5); 1993; 175-177

Viscosities of aqueous sol. of  $\alpha$ -D-glucose, sucrose, apple pectin (AP) and gum arabic (GA), as well as of various binary mixtures of these sol. were determined. Aqueous mixtures of  $\alpha$ -D-glucose and sucrose exhibited a small increase in viscosity with increasing sucrose concn. Addition of AP to binary mixtures gave solutions a viscosity similar to that of GA. The results indicate the possibility of preparation of edible glues and thickeners based on sucrose-pectin interactions is considered. BV

1933

Kubik (S) and Wulff (G). **Characterization and chemical modification of amylose complexes.** *Starch/Staerke* 45(6); 1993; 220-225

Complexes of amylose with various organic guest molecules were studied by circular dichroism spectroscopy and microcalorimetry in aqueous sol. The structure of the complexes and the mechanism of their formation were determined. Results indicated that amylose can adjust its helix conformation to the shape and structure of the guest molecule included. Investigations about intramolecular and intermolecular crosslinking of amylose indicate that the complexing behaviour of amylose can be manipulated specifically. AA

1934

Jane (J).  **$^{13}\text{C}$ -NMR study of interactions between amylodextrin and neutral salts.** *Starch/Staerke* 45(5); 1993; 172-175

$^{13}\text{C}$ -NMR was used to study interactions between amylodextrin and alkali metal and alkaline-earth metal salts in aqueous solutions. Ethyl, isopropyl and t-butyl alcohols were used as model compounds.  $^{13}\text{C}$ -NMR spectra of the alcohols in KCl sol. showed that C atoms carrying hydroxyl (-OH) groups were shifted up-field, whereas those C atoms without -OH groups were shifted down-field. A secondary or a tertiary hydroxyl C was shifted to a greater extent compared with a primary hydroxyl C. Potassium thiocyanate was an exception; instead of causing up-field shifts on hydroxyl carbons in amylodextrin and in alcohols, potassium thiocyanate caused down-field shifts of C-1 and C-4 of amylodextrin, a chemical shift pattern that resembled those of amylodextrin-triiodide and other amylodextrin helical complexes. AA

## Starch

1935

Haska (N) and Ohta (Y). **Effect of cellulase addition on hydrolysis of sago starch granules by raw starch digesting amylase from *Penicillium brunneum* No.24.** *Starch/Staerke* 45(7); 1993; 237-241

A glucoamylase (glucan 1,4- $\alpha$ -glucosidases, EC 3.2.1.3) from *Penicillium brunneum* No. 24 with strong ability to digest sago starch granules (SSG) was partially purified using DEAE-cellulose. Specific activity of the enzyme did not increase proportionally with purification. The purified enzyme was combined with commercial cellulase (10 unit/g starch) from *Trichoderma reesei* to improve hydrolysis of SSG. A synergistic action was observed for glucoamylase and cellulase hydrolysis of SSG at 45°C, pH 4.5 for 30 min. Addition of glucoamylase (5 IU/g starch) to the reaction mixture (glucoamylase and cellulase 10 IU and 10 unit/g starch, respectively) at 24 h intervals resulted in almost complete hydrolysis of SSG to glucose after 120 h. BV

1936

Lammers (G), Stamhuis (EJ) and Beenackers (ACM). **Continuous production of hydroxypropyl starch in a static mixer reactor.** *Starch/Staerke* 45(7); 1993; 227-232

A novel type of reactor for chemical derivatization of starch pastes is presented. The design is based on the application of static mixers. The reactor shows excellent plug flow behaviour with a Peclet number of approx. 100. Viscosity behaviour of concn. starch pastes in the static mixer reactor can be described by:  $n/\text{app} = K_e^{[Bm(\text{starch}) + C/T-DW + (n-1)\ln \gamma]}$ , where  $K = 3.063 \times 10^{-4} \text{ Pa.s.}$ ,  $B = 12.03$ ,  $C = 4.134 \times 10^3 \text{ l/K}$ ,  $D = 2.83 \times 10^{-2} \text{ kg dry starch/kJ}$  and  $n = 0.494$ .  $m(\text{starch})$  is the mass fraction dry starch in the paste. The reactor was used for production of hydroxypropyl starch with a molar substitution (MS) of up to 0.5. Propylene oxide conversions of 90% were reached within 9 min of reaction time which compares favourably with conventional production processes. The reactor was modelled as a non-isotherm plug flow reactor. Experimental results on propylene oxide conversion and MS of the derived starch are in good agreement with model calculations. AA

1937

Haska (N) and Ohta (Y). **Alcohol fermentation from sago starch granules using raw sago starch digesting amylase from *Penicillium brunneum* No. 24 and *Saccharomyces cerevisiae* No. 33.** *Starch/Staerke* 45(7); 1993; 241-244

Ethanol production from sago starch (SS) granules by simultaneous hydrolysis and fermentation using glucoamylase (glucan 1,4- $\alpha$ -glucosidase, EC 3.2.1.3) from *P. brunneum* No. 24 and *Sacch. cerevisiae* No. 33 was studied. Starch granules were first hydrolysed with glucosidase for 24 h, followed by fermentation with the addition of yeast. Optimum conditions for conversion of 5% SS were 30-35°C and pH 4.8 giving an ethanol yield of 44% after 72 h incubation. BV

1938

MacGregor (EA). **Relationships between structure and activity in the  $\alpha$ -amylase family of starch-metabolising enzymes.** *Starch/Staerke* 45(7); 1993; 232-237

An overview of current ideas connecting structure to activity for a variety of starch-hydrolysing enzymes related to  $\alpha$ -amylases (EC 3.2.1.1, e.g. pullulanase, EC 3.2.1.41; isoamylase, EC 3.2.1.68; oligo-1,6-glucosidase, EC 3.2.1.10; neopullulanase, EC 3.2.1.-; glycogen-branching enzymes, EC 2.4.1.18) is presented. Aspects considered include: The ( $\beta/\alpha$ )8-barrel and the active site; Specificity differences;  $\alpha$ -Amylases and maltase; Cyclodextrin glucanotransferases (EC 2.4.1.19); and Enzymes with action on alpha-1,6-glucosidic bonds. AA

1939

Jane (J). **Mechanisms of starch gelatinization in neutral salt solutions.** *Starch/Staerke* 45(5); 1993; 161-166

DSC thermograms showed that salt affected the onset temp. ( $T_0$ ) and enthalpy change ( $\Delta H$ ) of starch gelatinization and that the effect differed by type of salt and concn. Anion effects seemed to parallel the structure-making and structure-breaking effects of water. At all concn., sulphate ions increased  $T_0$  and  $\Delta H$  but thiocyanate suppressed them.  $T_0$  and  $\Delta H$  were affected by cations in a complex mode. In  $\text{CaCl}_2$  (3 mol/kg, m) or  $\text{LiCl}$  (7-10 m) sol., starch gelatinized at room temp. but did not gelatinize in  $\text{NaCl}$  or  $\text{KCl}$  sol. at any concn. Light micrographs taken at room temp. showed that in  $\text{KSCN}$  and  $\text{KI}$  solutions ( $> 2 \mu$ ) starch

gelatinization began at the hilum but in  $\text{CaCl}_2$  (3 m) and  $\text{LiCl}$  solutions (7-10 m) starch gelatinization started at the periphery. It was concluded that the mechanism of starch gelatinization in salt sol. can be attributed to: (1) structure-making and structure-breaking effects in water; and (2) electrostatic interactions between salts and hydroxyl groups of starch. AA

1940

Sarathi Reddy (OV) and Basappa (SC). **Selection and characterization of *Endomycopsis fibuligera* strains for one-step fermentation of starch to ethanol.** *Starch/Staerke* 45(5); 1993; 187-194

Relationships between amylolytic activity and 1-step fermentation of starch to ethanol by strains of *Endomycopsis fibuligera* NRRL 76 were investigated. A suitable strain was selected and conditions for the bioconversion of cassava starch (CS) to ethanol were optimized. From 230 yeast strains, strain NRRL 76 produced consistently higher levels of  $\alpha$ -amylase and glucoamylase as well as ethanol from sugar and starch substrates. Strain NRRL 76 grew optimally at pH 6.0 and 30°C. Under aeration for 1 day followed by 3 days without aeration, max. ethanol concn. was 92.0 and 73.5 g/l in media containing 300 and 200 g/l CS, respectively. NRRL 76 process compared with other one-step process reported was found to be better than the others. Strain NRRL 76 also converted waxy rice (250 g/l) with ethanol yields of 50.4-52.0 g/l. BV

## Sugarcane

1941

Ravindranath (K) and Subbaratnam (GV). **Management of sugarcane scale insect *Melanaspis glomerata* (Green).** *Indian Sugar* 44(4); 1994; 333-343

Twelve treatments viz. combinations of sett dip, stubble drench, detrashing along with insecticidal sprays of malathion, triazophos, methamidophos, carbofuran, cypermethrin and isofenphos were administered on plant and ratoon crops in 1986-87 and 1987-88, with sugarcane var. CoA 7602. For the management of sugarcane scale insect, *M.*

*glomerata* (Green), sett dip/stubble drench with malathion 0.1% + detrashing + malathion 0.1% spray twice was highly effective followed by detrashing + malathion 0.1% spray twice, sett dip/stubble drench with malathion 0.1% + detrashing treatments gave higher cane yield, better quality of juice and increased monetary returns. SRA

1942

Kannappan (K), Karamathullah (G) and Kumaraswamy (K). **Methods for alleviating the ill effects of drought conditions of sugarcane.** *Indian Sugar* 44(5); 1994; 349-351

To determine a method to offset the adverse effect of drought in summer on sugarcane crop, experiments were conducted in 6 locations in Periyar, Thiruchirapalli and Dharmapuri districts, India, during 1986-87 in clay loam soils. Sugarcane var. CO 6304 was grown and treated in 6 different ways, viz. (1) Trash mulching along ridges before lift irrigation; (2) application of 125 kg muriate of potash/ha during 1st wk of May; (3) spraying 2.5% Kaoline sol. on the crop at the rate of 500 l/ha during 1st wk of May; (4) trash mulching along ridges before lift irrigation and applying 125 kg of muriate of potash/ha during 1st wk of May; (5) trash mulching along ridges before lift irrigation and spraying 2.5% Kaoline sol. on the crop at the rate of 500 l/ha during 1st wk of May. (6) control. Treatment 1 was found effective with regard to cane population (92,100/ha), cane yield (117.2 t/ha), commercial cane sugar (CCS) (12.7%), sugar yield (15.0 t/ha), when compared to control which showed 87200 cane population/ha, 109.6 t/ha cane yield, 12.5% CCS, and 13.6 t/ha sugar yield. SRA

1943

Kapseu (C), Ahmed (A) and Tedga (N). **Reduction of losses during refining of sugar cane.** *Journal of Food Engineering* 20(1); 1993; 45-53

Losses occurring during cane sugar refining are identified and solutions to reduce them are proposed. The most important sites of loss are: in the refinery (on pumps, pipelines, flanges, filter plates, clarifiers); at the A jet (in the vacuum system); during purification (in purged

residues); at the C jet; and during evaporation (capacity of evaporators too small, encrustation of heating surfaces). Results indicate that capacity of cooking and melting vats should be increased and all equipment regularly cleaned and maintained to minimize losses during refining. Increasing enzyme activity in syrup can depolymerize starch which may clog filters and inhibit crystallization. Replacement of all oxidizable equipment is also suggested. Proper training of personnel is recommended. BV

## Sugarcane juices

1944

Lal (U), Srivastava (SC) and Verma (SK). **Post harvest deterioration in sugarcane vis-a-vis gur and juice.** *Indian Sugar* 44(5); 1994; 345-347

To study the post harvest deterioration in sugarcane juice from var. COS 687 and COJ 64 (early), COS 767 and COS 7918 (medium), and COS 802 and B0.91 (late maturing) were obtained and juice was converted into gur. Loss in cane wt., juice extraction, gur % cane, gur % juice and gur colour were pronounced in early maturing var. throughout cane staling period of 6 days. The rate of deterioration in cane, gur and juice was slow for 2 days and was faster later on. Losses due to inversion in all harvested cane was found negligible upto 48 h of harvesting. SRA

## BAKERY PRODUCTS

1945

Kamaliya (KB). **Brick-oven (construction and handling).** *Indian Miller* 25(1); 1994; 15-19

Construction of less expensive brick-oven for bakery products suitable for semi-urban and rural areas is described illustrating with diagram. Aspects covered are size, construction and materials required. SRA

1946

Viljoen (BC) and Lues (JFR). **The microbial populations associated with post-fermented dough and compressed baker's yeast.** *Food Microbiology* 10(5); 1993; 379-386

Quantification of the organisms isolated from the compressed yeast block indicated that the microbial populations were dominated by high numbers of culture yeasts, ranging between  $1.6 \times 10^{10}$  and  $1.8 \times 10^{10}$  cfu/g accounting for 91.9% of the population. Bacterial species accounted for  $5.0 \times 10^7$  to  $6.0 \times 10^7$  cfu/g (0.3%), while wild yeast species comprised  $1.3 \times 10^9$  to  $1.4 \times 10^9$  cfu/g (7.6%). The microbial community of the dough at the final stage of proofing consisted 2.1% bacteria, 7.8% wild yeast and 89.7% culture yeast. The bacterial genus *Lactobacillus* and wild species of genus *Saccharomyces* dominated the microbial population in both the compressed yeast and post-fermented dough. SRA

## Bread

1947

Dural (NH) and Hines (AL). **Adsorption of water on cereal-bread type dietary fibers.** *Journal of Food Engineering* 20(1); 1993; 17-43

A study involving the water sorption characteristics of cereal-bread type food fibres was conducted using gravimetric adsorption apparatus. Water adsorption data for 4 dietary fibres, corn bran, wheat bran, oat fibre and rice fibre, were measured at 278, 288, 298 and 310 K. Results showed that adsorption of water vapour on these fibres is primarily due to physical forces, and all fibres investigated exhibited energetically heterogeneous surfaces. The distribution of the major components of the dietary fibre had an impact on the fibre's water sorption capacity. Isotherm data were correlated using the BET and GAB multilayer adsorption models. The BET equation gave accurate correlations for up to 35-40% of the saturation pressure, while the GAB equation provided much better correlation of data for the higher relative pressures. AA

1948

Huang (S), Betker (S), Quail (K) and Moss (R). **An optimized processing procedure by response surface methodology (RSM) for northern-style Chinese steamed bread.** *Journal of Cereal Science* 18(1); 1993; 89-102

The procedure for manufacture of northern-style Chinese steamed bread was optimized using response surface methodology screening. The technique accommodates a range of flour strengths (medium and strong) and is suitable for investigating flour requirements for the bread. Optimized settings for processing variables were selected. The procedure adopted include: Farinograph mixer, 300 g bowl, speed 60 rpm; compressed yeast, 1.5%; water addition, 70% of Farinograph water absorption; fermentation time, 60 min; fermentation temp., 32°C; RH, 85%; proof time, 20 min; steam generation rate, 155 g of steam/m<sup>3</sup>/min; and steam time, 20 min. Results from the screening trials indicated that up to 20 sheeting passes significantly improved the quality of steamed bread made from both medium and strong flour. Mixing time had a significantly positive effect on the quality of steamed bread made from strong flour, while remixing had a significantly negative effect on that made from the medium strength flour. BV

1949

Javanainen (P) and Linko (YY). **Mixed-culture pre-ferments of lactic and propionic acid bacteria for improved wheat bread shelf life.** *Journal of Cereal Science* 18(1); 1993; 75-88

An optimal lactic acid (LA) and propionic acid (PA) bacteria mixed-starter culture, containing naturally-formed PA in sufficient quantity to prevent fungal growth and increase shelf life of wheat bread, was developed. The effects of pre-fermentation (PF) temp. and time, type of flour and combination of LA and PA bacteria on acid formation and wheat bread properties were studied. Effects of the LA and PA on leavening capacity (LC) of the dough were also investigated. LC was decreased by the acids formed during PF. Slightly sour wheat bread resulted, which had a pH of 5.4-6.0, titratable acidity of 3.9-5.6 and an acceptable LA:acetic acid ratio for sour bread making. Shelf life was increased up to 10 days. BV

1950

Pettersson (D) and Aman (P). **Effects of feeding diets based on wheat bread or oat bran bread to broiler chickens.** *Journal of Cereal Science* 17(2); 1993; 157-168

Broiler chickens (Rass) were fed with bread baked with wheat flour and bread baked with wheat flour partly replaced by oat bran. Diets were fed with and without supplementation of a fibre-degrading enzyme in order to study the effects of dietary fibre on animal production, serum cholesterol and carcass composition. Least growth and poorest feed conversion efficiency were found in chickens fed the oat bran bread diet; enzyme supplementation, however, improved live wt., cumulative feed intake and feed conversion efficiency. Serum lipid concn. also increased to levels similar to those of chickens fed the wheat bread diet. Enzyme supplementation of the wheat bread diet yielded no significant improvements. Carcasses of chickens fed the oat bran bread diet were lower in fat and higher in protein than those of chickens fed the other diets. BV

## MILK AND DAIRY PRODUCTS

1951

Sarkar (S) and Misra (AK). **Ultrafiltration as a process in the manufacture of dairy products - a review.** *Indian Journal of Dairy Science* 47(2); 1994; 80-93

This review covers aspects on the ultrafiltration techniques for Cheddar cheese (quality of milk, amount of rennet, firmness of curd, starter activity, UF-concn., flavour, yield, problems), Mozzarella cheese, Domiati cheese, Feta cheese, Quarg cheese, shrikhand, and other dairy products and food additives. 177 references. SRA

1952

Shimazaki (K), Tanaka (T), Kon (H), Oota (K), Kawaguchi (A), Maki (Y), Sato (T), Ueda (Y), Tomimura (T), Shimamura (S). **Separation and characterization of the C-terminal half molecule of bovine lactoferrin.** *Journal of Dairy Science* 76(4); 1993; 946-955

The C-terminal half molecule (C lobe) of bovine lactoferrin was isolated by mild tryptic hydrolysis of lactoferrin followed by gel filtration and ion-exchange chromatography. Identity of the fragment was established by determining its N-terminal and C-terminal amino acid sequences and comparing them

with the amino acid sequence of intact lactoferrin. The isoelectric point of the C lobe ranged between pH 6.2 and 6.5, as measured by isoelectric focusing on polyacrylamide gels. The circular dichroic spectrum in the range of 250-350 nm of the C lobe differed slightly from that of intact lactoferrin. The pattern of lectin reactivity was similar for both the C lobe and intact lactoferrin. The C lobe showed partial antigenic identity with intact lactoferrin as demonstrated by the double immunodiffusion method, and pH dependence of Fe binding of C lobe was the same as that of intact lactoferrin molecules. AA

1953

Wiederholt (KM) and Steele (JL). **Prophage curing and partial characterization of temperate bacteriophages from thermolytic strains of *Lactococcus lactis* ssp. cremoris.** *Journal of Dairy Science* 76(4); 1993; 921-930

The thermolytic response observed in 2 strains (SK11 and US3) of *Lactococcus lactis* ssp. cremoris was investigated. Lysis was induced 2-2.5 h after either strain was transferred from 30 to 37°C or exposed to mitomycin C. Temp. shift resulted in slow incomplete lysis. Temperate phages were isolated following mitomycin C induction from both strains SK11 (SK11-T1) and US3 (US3-T1). Restriction patterns of DNA isolated from these phages were indistinguishable upon agarose gel electrophoresis. In total genomic DNA preparations, phage DNA bands developed 1.5-2 h after mitomycin C treatment. No phage DNA bands were observed during lysis induced by the temp. shift. Analysis of concentrated phage samples by TEM showed a multitude of intact US3-T1 phage from mitomycin C induction of US3. In samples from temp. inductions of US3, only a few intact bacteriophage particles with a different appearance were observed. A prophage-cured derivative of strain US3, designated US3-12, was obtained after exposure to UV irradiation. US3-12 continued to lyse in the presence of mitomycin C and at increased temp.; its mitomycin C lysis curve then resembled its lysis curve induced by the temp. shift. AA

1954

Walker (DK) and Gilliland (SE). **Relationships among bile tolerance, bile salt**

**deconjugation, and assimilation of cholesterol by *Lactobacillus acidophilus*.** *Journal of Dairy Science* 76(4); 1993; 956-961

Relationships were examined among growth in the presence of bile, deconjugation of sodium taurocholate (ST) and assimilation of cholesterol by 19 cultures of *Lactobacillus acidophilus*. Cultures of *L. acidophilus* were grown at 37°C in lactobacilli MRS broth supplemented with sodium thioglycollate, ST and cholesterol (cholesterol phosphatidyl choline micelles). Deconjugation activity was max. in the late exponential phase of growth, which coincided with max. assimilation of cholesterol. Considerable variation existed among cultures in their ability to grow in the presence of bile, to deconjugate ST and to assimilate cholesterol. However, statistical analyses revealed no significant correlations. AA

1955

Youling (LX), Dawson (KA) and Liping (W). **Thermal aggregation of  $\beta$ -lactoglobulin: effect of pH, ionic environment, and thiol reagent.** *Journal of Dairy Science* 76(1); 1993; 70-77

Heat-induced  $\beta$ -lactoglobulin (1.2 mg/ml) aggregation in NaCl, CaCl<sub>2</sub> and thiol-blocking agent (N-ethylmaleimide) solutions was determined by measuring dynamic turbidity changes at temp. ranging from 25 to 96°C.  $\beta$ -Lactoglobulin in distilled water exhibited a single transition (greater than or equal to 76°C) in protein-protein interaction (aggregation). An increase in pH from 5.50 to 6.50 suppressed the transition, whereas addition of NaCl (0.02-1.0M) and CaCl<sub>2</sub> (0.005-0.2M) promoted the transition. N-ethylmaleimide (4.0-10.0mM) decreased transition temp. and in the absence of salts, induced a 2nd transition. However, the combination of N-ethylmaleimide and NaCl or CaCl<sub>2</sub> produced a single, large transition peak. Results indicated that  $\beta$ -lactoglobulin aggregation is most sensitive to low pH, greatly depends on the type and concn. of specific salts and involves electrostatic and possibly hydrophobic forces and sulphydryl reactions. AA

1956

Attaie (R), Richter (RL) and Reine (AH). **Low molecular weight branched-chain and n-chain fatty acids in caprine and bovine colostrum.** *Journal of Dairy Science* 76(1); 1993; 62-69

Colostrum from French-Alpine and Anglo-Nubian goats and Holstein cows was collected and analysed for both total and free fatty acids of  $\leq 12$  carbon atoms. Short-chain volatile fatty acids were separated from long-chain fatty acids using simultaneous distillation extraction. The n-butyl esters of fatty acids were quantified by GC and their identity was confirmed by GC-MS. Concn. of decanoic acid was 33 and 83% less in Holstein colostrum than in colostrum from Alpine and Nubian goats, respectively. Colostrum from Nubian goats contained twice as much decanoic acid as colostrum from Alpine goats. Free fatty acids in colostrum that differed between spp. but not between goat breeds were octanoic and decanoic acids. These respective fatty acids were approx. 2 and 3x greater in colostrum from goats than in colostrum from Holsteins. The quantity of decanoic acid was different between goat breeds and between animals spp. The ratio of total fatty acid concn. to free-state concn. for hexanoic acid appeared to be useful for differentiating between Nubian and Alpine goat colostrum as well as between Nubian and Holstein colostrums. AA

1957

Relkin (P), Launay (B) and Eynard (L). **Effect of sodium and calcium addition on thermal denaturation of apo- $\alpha$ -lactalbumin: a differential scanning calorimetric study.** *Journal of Dairy Science* 76(1); 1993; 36-47

Changes in thermodynamic parameters related to thermal denaturation (5-100°C) of commercial  $\alpha$ -lactalbumin in Ca<sup>2+</sup> depleted form were determined by DSC. Thermograms obtained from  $\alpha$ -lactalbumin dissolved in distilled water showed 2 peaks corresponding to Ca<sup>2+</sup> free (apo- $\alpha$ -lactalbumin) and bound (holo- $\alpha$ -lactalbumin) forms, respectively. Because the commercial Ca<sup>2+</sup> free sample contained both forms, the enthalpy change corresponding to pure apo- $\alpha$ -lactalbumin was calculated from the increase in peak area vs. added Ca<sup>2+</sup>. The transition temp. and the enthalpy change of the apo- $\alpha$ -lactalbumin form

were also dependent on Na concn. The heat capacity change following denaturation was calculated from the linear variation of the apparent enthalpy change vs. the transition temp. of the apo- $\alpha$ -lactalbumin form to which Na at various concn. had been added. Addition of Na<sup>2</sup>-EDTA to commercial holo- $\alpha$ -lactalbumin lowered the apparent enthalpy change and a glass-like transition was observed during a 2nd heating run. The calculated thermodynamic parameters were of the same order of magnitude as most published data obtained by different methods (circular dichroism, fluorescence and NMR) at much lower protein concn. AA

1958

Romero (DA) and Klaenhammer (TR). **Transposable elements in lactococci: a review.** *Journal of Dairy Science* 76(1); 1993; 1-19

Genetic studies have identified the presence of transposable elements within the genus *Lactococcus*, which includes industrially important microorganisms used in the production of fermented dairy products. 3 insertion sequences have been fully characterized in addition to several reports of transposition-like events. The 3 insertion sequence elements, ISS1, IS904 and IS981, exhibit the physical and genetic properties characteristic of known insertion sequences. They are closely related to insertion sequences isolated from a wide variety of microorganisms. In lactococci, insertion sequence elements are associated with lactose and sucrose metabolism, proteinase activity, nisin production and immunity, conjugal transfer determinants and bacteriophage resistance, which are attributes significant for growth in a milk environment. The characteristics, involvement in lactococcal evolution, and recent developments as tools for genetic engineering of the lactococcal elements are discussed. 117 references. AA

## Milk

1959

Sarkar (S) and Misra (AK). **Preservation of raw milk by LP-system.** *Indian Journal of Dairy Science* 47(2); 1994; 129-132

The effect of thiocyanate (SCN) and H<sub>2</sub>O<sub>2</sub> in the ratio of 10:10, 20:10, 20:20, 20:25, 25:10, 25:20, 25:25, 25:30, 30:10, 30:20, 30:25, 30:30 and 30:45 p.p.m. were studied to obtain the optimum levels required to preserve cow and buffalo milk at 15 and 35 C, by LP system. A combination of 20:10 and 20:20 p.p.m. (SCN:H<sub>2</sub>O<sub>2</sub>) was found optimum to exhibit max. preservative effect (PE) in cow and buffalo milk respectively at both temp. PE of LP-system got reduced with rise in temp. and duration of storage. LP-system is recommended for raw milk preservation under field conditions in tropical countries. SRA

1960

Hartel (RW) and Espinel (LA). **Freeze concentration of skim milk.** *Journal of Food Engineering* 20(2); 1993; 101-120

Freeze concn. is an alternative to evaporation and reverse osmosis for concn. of liquid foods. However, current commercial freeze concn. technology is not economically competitive with the more established alternatives. Understanding the principles by which ice crystals liquid grow in foods would aid in furthering freeze concn. technology. Parameters influencing heat balance conditions in a suspension crystallizer were studied to determine the conditions at which optimal crystal growth could be attained in skim milk. Refrigerant temp. agitation rate and surface area of crystals in the crystallizer were studied for their effects on IC growth rates in seeded, batch crystallization. Experiments were conducted at constant refrigerant temp., constant refrigeration subcooling (bulk temp. minus refrigerant temp.) or constant refrigerant subcooling with slurry removal from the crystallizer. The effects of seed addition level were also studied. Results suggest that large crystals can be grown in reasonably short times (800  $\mu$ m diam. in approx. 5 h) in batch crystallizers when heat balance conditions are maintained at high levels. The most important parameters for maintaining optimal heat balance conditions were crystal surface area and refrigerant temp. By controlling these parameters during ice crystallization, a competitive freeze concn. technology may be developed. BV

1961

Ventling (BL) and Mistry (VV). **Growth characteristics of bifidobacteria in ultrafiltered milk.** *Journal of Dairy Science* 76(4); 1993; 962-971

Five replicates of raw skim milk were ultrafiltered at 54°C to total protein concn. ratio of 2:1, 3:1, 4:1 and 5:1. *Bifidobacterium bifidum* and *B. longum* were inoculated at 5% into skim milk that was not ultrafiltered (UF) (1:1) and into UF skim milks followed by incubation at 37°C. Mean max. bacterial counts (cfu/ml) range and protein concn. ratio were from  $6.25 \times 10^8$  to  $1.69 \times 10^9$ , skim milk;  $4.42 \times 10^8$  to  $3.56 \times 10^9$ , 2:1;  $2.62 \times 10^8$  to  $3.94 \times 10^9$ , 3:1;  $6.67 \times 10^8$  to  $1.88 \times 10^9$ , 4:1; and  $2.90 \times 10^9$  to  $3.59 \times 10^9$ , 5:1. Mean developed acidity at max. *B. bifidum* population in skim milk was 0.16% and pH was 5.55. The 5:1 concentrate had a higher mean developed acidity of 0.57% at pH 5.35, which was similar to that of skim milk. Trends were similar for *B. longum*. Because of increased buffering capacity of highly concentrated UF milks, pH 5.5 or higher was maintained longer, along with high developed acidity. SEM showed distinct morphological variations between bifidobacteria grown in broth vs. those grown in milks. AA

1962

Huhtanen (P), Miettinen (H) and Ylinen (M). **Effect of increasing ruminal butyrate on milk yield and blood constituents in dairy cows fed a grass silage-based diet.** *Journal of Dairy Science* 76(4); 1993; 1114-1124

1963

El Samragy (YA), Hansen (CL) and McMahon (DJ). **Production of ultrafiltered skim milk retentate powder. I. Composition and physical properties.** *Journal of Dairy Science* 76(2); 1993; 388-392

Raw skim milk retentate with 20% solids produced by ultrafiltration was subjected to different heat treatments (HT) and pH adjustments prior to spray-drying. HT were 65°C for 30 min, 75°C for 28 s, and 85°C for 28 s. pH was adjusted to 6.4, 6.7 and 7.0. Retentate powders were analysed for moisture, protein, lactose, fat, ash, titratable acidity and

pH. Physical property detn. included solubility index, dispersibility, viscosity, scorched particles, poured density, packed density and water absorption isotherm. No interaction effects of HT and pH adjustment were observed. pH adjustments affected ash content and solution viscosity. HT affected solubility and poured density. pH adjustments and HT had only minor effects on the measured properties. AA

1964

Payne (FA), Hicks (CL) and Pao (SS). **Predicting optimal cutting time of coagulating milk using diffuse reflectance.** *Journal of Dairy Science* 76(1); 1993; 48-61

A method based on changes in diffuse reflectance during milk coagulation was developed for predicting the optimal cutting time of coagulating milk. Time between enzyme addition to milk and occurrence of inflection point on the diffuse reflectance curve was measured at various concn. of milk fat, protein, calcium and enzyme at various temp. and pH levels. Inflection time was found to correlate with measured Formagraph<sup>TM</sup> cutting time. Using calf rennet and fermentation-derived chymosin enzymes, a cutting time prediction equation was developed by incorporating the inflection time into a multiple linear regression equation with milk protein content. When validated, the prediction equation had a s.e. of prediction of 0.9 and 2.4 min for 2 different validation tests and was sufficiently accurate for commercial application. A cutting time prediction model that used only the magnitude of the change in diffuse reflectance was tested. Changes in diffuse reflectance during coagulation were a function of milk pH, temp., fat and protein content. Thus, diffuse reflectance changes can be used to predict optimal cutting time only when these milk property values are known or controlled. AA

1965

Agabriel (C), Coulon (JB), Marty (G) and Bonaiti (B). **Changes in fat and protein concentrations in farms with high milk production.** *Journal of Dairy Science* 76(3); 1993; 734-741

1966

Schutz (MM), Freeman (AE), Lindberg (GL) and Beitz (DC). **Effects of maternal lineages grouped by mitochondrial genotypes on milk yield and composition.** *Journal of Dairy Science* 76(2); 1993; 621-629

1967

Hill (JP). **The relationship between  $\beta$ -lactoglobulin phenotypes and milk composition in New Zealand dairy cattle.** *Journal of Dairy Science* 76(1); 1993; 281-286

1968

Drackley (JK) and Elliott (JP). **Milk composition, ruminal characteristics, and nutrient utilization in dairy cows fed partially hydrogenated tallow.** *Journal of Dairy Science* 76(1); 1993; 183-196

Milk fat content was not significantly different in milk from cows fed diets supplemented with 0, 2, 4 or 6% tallow. Tallow decreased contents of crude protein and SNF in milk but increased production of non-protein nitrogen. % of short- and medium-chain fatty acids in milk fat decreased linearly, whereas % of C18:1 increased with increasing dietary tallow. BV

1969

Choi (IW) and Jeon (IJ). **Patterns of fatty acids released from milk fat by residual lipase during storage of ultra-high temperature processed milk.** *Journal of Dairy Science* 76(1); 1993; 78-85

Patterns of fatty acids released from milk fat and types of residual lipase activity in UHT milk were investigated. Commercial UHT milk samples obtained immediately after processing were stored at 23 and 35°C and analysed for both free fatty acids (FFAs) and lipase activities. Results showed that concn. of short-chain FFAs, except lauric acid, changed little at 23°C during 12 wk of storage. At 35°C, however, concn. of all short-chain FFAs showed steady increases, ranging from 9% for caprylic to 45% for lauric acid. Concn. of long-chain FFAs increased moderately (7-20%) at 23°C, but their increases were much higher (26-63%) at 35°C. Patterns of release of FFAs acids were similar at both temp. However, the ratios of the long-chain FFAs released in UHT milk were

different from those of FFAs acids of milk fat. Residual lipase activities were detected in UHT milks as well as in their centrifugal fractions. Cream fractions showed the highest lipase activities, followed by aqueous supernatant and casein precipitates. Cream fractions preferentially hydrolysed long-chain FFAs from milk fat, whereas aqueous supernatant fractions hydrolysed both short-chain and long-chain FFAs. AA

1970

Ha (JK) and Lindsay (RC). **Release of volatile branched-chain and other fatty acids from ruminant milk fats by various lipases.** *Journal of Dairy Science* 76(3); 1993; 677-690

Bovine, ovine and caprine milk fats were treated with pregastric lipases (kid, calf and lamb), microbial lipases (*Candida cylindracea*, *Aspergillus niger* APF12, *Rhizopus arrhizus*, *Penicillium roqueforti* R10 and *Mucor zavanicus* Map 10), porcine pancreatic lipase or milk lipase. All 3 pregastric lipases preferentially hydrolysed volatile branched-chain and short n-chain fatty acids from each milk fat. Pregastric lipases also released a relatively low proportion of C<sub>10</sub> from bovine milk fats but a high proportion of C<sub>10</sub> from caprine milk fat. Milk lipase released very low concn. of butanoic acid and did not release 4-methyloctanoic acid in significant amounts except from caprine milk fat. Ovine milk fat yielded a substantially greater concn. of butanoic acid than did bovine or caprine milk fats, when it was hydrolysed by porcine pancreatic lipase. *C. cylindracea* lipase yielded high amounts of volatile n-chain fatty acids nonselectively and only small quantities of volatile branched-chain fatty acids. High amounts of medium-chain branched fatty acids were produced by kid, *P. roqueforti*, *A. niger* and *R. arrhizus* lipases. AA

1971

Baranyi (M), Boesze (Z), Buchberger (J) and Krause (I). **Genetic polymorphism of milk proteins in Hungarian spotted and Hungarian grey cattle: a possible new genetic variant of  $\beta$ -lactoglobulin.** *Journal of Dairy Science* 76(2); 1993; 630-636

1972

Hurley (WL), Grieve (RCJ), Magura (CE), Hegarty (HM) and Zou (S). **Electrophoretic comparisons of lactoferrin from bovine mammary secretions, milk neutrophils, and human milk.** *Journal of Dairy Science* 76(2); 1993; 377-387

Lactoferrin and Ig are the major glycosylated proteins in whey preparations from colostrum, milk, nonlactating bovine mammary secretions and milk collected after intramammary endotoxin challenge. Lactoferrin was isolated from these sources and from bovine mammary tissue (nonlactating) and bovine milk neutrophils. Mol. wt. forms of isolated lactoferrins were separated by SDS-PAGE. Apparent mol. wt. forms of lactoferrin (approx. 83 and 87 kDa) did not differ among lactoferrins isolated from mammary secretions or from mammary tissue, but lactoferrin isolated from milk neutrophils migrated as different mol. wt. bands in the gels (approx. 87 and 91 kDa). Human milk lactoferrin also separated as 2 distinct bands in the gels. All forms of lactoferrin were glycosylated. Differences were distinct in the glycosylation pattern of lactoferrins from human milk, bovine nonlactating mammary secretion and bovine milk neutrophils. Enzymic deglycosylation of lactoferrins from these sources resulted in migration of each as a single band (approx. 77 kDa). Results indicated that apparent mol. wt. forms of lactoferrin observed by separation by SDS-PAGE are not the result of genetic variance or differential glycosylation at different stages of mammary gland function. Nevertheless, the forms of lactoferrin result from the presence of glycans on the protein. AA

1973

Lanzanova (M), Mucchetti (G) and Neviani (E). **Analysis of conductance changes as a growth index of lactic acid bacteria in milk.** *Journal of Dairy Science* 76(1); 1993; 20-28

Automatic monitoring of the metabolic activity of lactic acid bacteria (LAB) in milk may be a useful method for quality control of dairy fermentation processes. The analysis of changes in conductance was used to evaluate the growth and metabolic activity of 190 strains of LAB in milk. It is concluded that conductimetry is a valid method to evaluate the

properties and stability of a culture. Both detection time and generation time can be used to measure the activity of single- and mixed-strain cultures. BV

## Milk products

1974

Sarkar (S) and Misra (AK). **Implication of LP-system on manufacture of fermented milk products.** *Indian Journal of Dairy Science* 47(2); 1994; 133-139

The feasibility to manufacture fermented milk products (dahi, yoghurt and acidophilus milk) from milk preserved by LP-system (SCN and H<sub>2</sub>O<sub>2</sub>) activated at 20:10 for cow milk and 20:20 for buffalo milk was evaluated. There was no significant difference in the diacetyl and acetone content and proteolytic activity of starters used in the manufacture of these products either in untreated or LP-treated cow and buffalo milk. SRA

## Cheese

1975

Moreno-Rojas (R), Amaro-Lopez (MA) and Zurera-Cosano (G). **Copper, iron and zinc variations in Manchego-type cheese during the traditional cheese-making process.** *Food Chemistry* 49(1); 1994; 67-72

Variations in mineral content were determined throughout the process of making cheese by taking samples of natural, pasteurized milk, with additions of rennet, curd, whey, pressed curd, pressing whey and cheese. The mean contents of Cu, Fe and Zn in cheese were 1.03, 6.71 and 37.86 µg/g, respectively, in fresh wt. The contribution of the consumption of this type of product to the daily-intake estimates in a Spanish diet are 3.22 µg/day for Cu, 20.9 µg/day for Fe, and 117.8 µg/day for Zn. By an analysis of variance, the existence of statistically significant differences ( $p < 0.001$ ) was confirmed in the products from the cheese-making for the 3 minerals, expressed as both fresh wt. and dry wt. Certain differences were observed in the groups formed on using a Scheffe homogeneity test ( $p < 0.05$ ) depending on whether the mineral content was expressed as fresh wt. or as dry wt. Slight rises in the

contents of the 3 minerals investigated as dry wt. were attributed mainly to the retention time of the minerals by the curd and secondly, to possible contamination occurring during the process. AA

1976

Kasrazadeh (M) and Genigeorgis (C). **Potential growth and control of *Salmonella* in Hispanic type soft cheese.** *International Journal of Food Microbiology* 22(2/3); 1994; 127-140

This study evaluated the growth and control of *Salmonella* serotypes in a soft Hispanic type cheese made in the lab. using commercial procedure and stored under vacuum at temp. ranging from 6 to 30°C. Study indicated that cheese having pH 6.6, 6.0% moisture content, 1.64% brine and manufactured without the use of any starter culture are excellent substrate for the growth of *Salmonella* spp. if the storage temp. is greater than or equal to 8°C. Growth of pathogen in cheese could be inhibited (a) when cheese is prepared from milk acidified with propionic acid to pH 5.9, and added with potassium sorbate (pH 6.0) at levels of greater than or equal to 0.3%, stored at less than or equal to 30°C. (b) adding sodium benzoate to cheese (pH 6.6) at level of less than or equal to 0.3% and stored at less than or equal to 12°C (c) the storage temp. kept at less than or equal to 6°C. SRA

1977

Emmons (DB), Ernstrom (CA), Lacroix (C) and Sauve (P). **Further considerations in formulas for predicting cheese yield from the composition of milk.** *Journal of Dairy Science* 76(4); 1993; 914-920

Reports simple general formula (type G) is described for predicting cheese yield from the composition of milk: yield = fat + complex of para-casein, Ca and P + salt + moisture + whey solids. The latter 3 were expressed as levels in cheese and multiplied by the unknown yield. Iterations of yield calculations resulted in the predicted yield, starting with an estimate of the yield. Further modifications of general formula (types H and J) did not need iterations. Type H used moisture. Type J used moisture in fat-free cheese. Types H and J are likely to be the

preferred formulae. Yield estimates with type G and H formulae were identical to estimates with type A and B formulae described previously (*Journal of Dairy Science* 73, 1365), which used moisture, but were different from those estimated with types C and J formulae, which used moisture in fat-free cheese. Using iterative calculations from Ca and P contents of cheese and milk, the yield coeff. was estimated with only small differences in Kc (the conversion factor of casein in milk to para-casein  $\text{CaH}_2\text{PO}_4$  in cheese). BV

1978

Visser (S). **Proteolytic enzymes and their relation to cheese ripening and flavor: an overview.** *Journal of Dairy Science* 76(1); 1993; 329-350

Proteolytic events taking place during cheese ripening are described, and the characteristics of the various proteolytic systems involved are reviewed. Some emphasis is placed on the proteolytic enzymes from starter bacteria because these, in particular, have been subjects of recent and current research. In cheese, the concerted action of residual milk-clotting enzyme, indigenous milk proteinases and starter proteinases provides suitable substrates for the starter peptidases, which ultimately generate small peptides and free amino acids. Deviations from such a delicately balanced process may lead to deviations from the desired cheese texture and flavour. A bitter flavour defect may develop in the ripening cheese when the degradation of slowly accumulating bitter peptides by suitable peptidases is inhibited. Cheese flavour is thought to be mainly generated by the further, non-proteolytic conversion of amino acids via enzymic and nonenzymic reactions. 211 references. AA

### Cheddar cheese

1979

Reinbold (RS), Hansen (CL), Gale (CM) and Ernstrom (CA). **Pressure and temperature during vacuum treatment of 290-kilogram stirred-curd Cheddar cheese blocks.** *Journal of Dairy Science* 76(4); 1993; 909-913

Pressure and temp. during vacuum treatment (VT) at 8.0 kPa of absolute pressure were determined at the centre and sides of 290-kg blocks of stirred-curd Cheddar cheese in stainless steel hoops, unpressed or pressed at 7.9 kPa of surface pressure prior to VT. Pressure and temp. in the vacuum chamber were also determined. Pressure at the centre of unpressed blocks decreased to an average of 11.9 kPa of absolute pressure, and pressure at the centre of pressed blocks decreased to an average of 17.0 kPa of absolute pressure during VT. Temp. at the centre of unpressed blocks decreased by an average of 5.9°C, and temp. at the centre of pressed blocks decreased by an average of 3.6°C during VT. Results indicated that pressing blocks prior to VT compressed curd, which created a barrier to rapid air and whey evacuation from blocks during VT. Entrapped air and whey may increase mechanical openness and may contribute to uneven moisture distribution in blocks of cheese. BV

### Cottage cheese

1980

Chen (JH) and Hotchkiss (JH). **Growth of *Listeria monocytogenes* and *Clostridium sporogenes* in Cottage cheese in modified atmosphere packaging.** *Journal of Dairy Science* 76(4); 1993; 972-977

Low fat Cottage cheese (pH 5.14) was inoculated with 3 strains of *Listeria monocytogenes*, serotypes 1a and 4b, and an isolate from a dairy processing plant, and *Clostridium sporogenes* ATCC 3584. Cheese was packaged with or without added dissolved CO<sub>2</sub> in polystyrene tubs overwrapped with or without high barrier heat shrink film and stored at 4, 7 and 21°C for up to 63 days. Conc'n. of CO<sub>2</sub> in the container headspace was 35% (v/v). CO<sub>2</sub> conc'n. in the headspace declined by one-third over the 63 days of storage at 4°C. *C. sporogenes* failed to grow under any condition applied in this study. In conventionally packaged Cottage cheese, *L. monocytogenes* increased from 10<sup>4</sup> to 10<sup>7</sup> cfu/g after lag phases of 28 and 7 days at 4 and 7°C, respectively. In contrast, *L. monocytogenes* failed to grow in Cottage cheese packaged with CO<sub>2</sub> and stored at 4°C up to 63 days and increased from 10<sup>4</sup> to 10<sup>5</sup> cfu/g in products

packaged with CO<sub>2</sub> at 7°C. Data suggest that addition of CO<sub>2</sub> to Cottage cheese to extend shelf life does not represent an increased *Listeria* or botulism hazard but that Cottage cheese could be a vehicle for listeriosis. AA

### Domiatl cheese

1981

Abou-Zeid (NA). **Utilization of the weed *Sonchus oleraceus* L. as vegetable rennet for domiatl cheese.** *Indian Journal of Dairy Science* 47(2); 1994; 140-144

The characteristics of Domiatl cheese manufactured with the vegetable (*Sonchus oleraceus* rennet (SOR) was compared with those of traditional Domiatl cheese made with calf rennet (CR) when it was fresh and during pickling. Cheese manufactured using SOR had lower moisture and pH, but it had higher acidity, soluble nitrogen, soluble tyrosine and soluble tryptophane. No significant variations between CR and SOR cheese were noticed in total volatile fatty acids, fat degradation and cheese yield. The SOR cheese had higher total proteolytic and lipolytic bacterial count. Coliform group was found in fresh SOR cheese, which disappeared after 1 wk of pickling. Cheese prepared with SOR had more pleasant and desirable flavour (P < 0.05) and softer texture. SRA

### Feta cheese

1982

Katsiari (MC) and Voutsinas (LP). **Manufacture of low-fat feta cheese.** *Food Chemistry* 49(1); 1994; 53-60

Feta cheese from ewe's milk containing 6.0 (control), 3.0 and 1.5% fat indicated that as the fat content of the cheese milk decreased, FDM, MNFS, yield values, proteolysis, lipolysis, body texture and flavour scores decreased; protein, moisture increased and salt, S/M, pH, acidity and the rheological properties unaffected. Good low-fat feta cheese with acceptable flavour, body and texture could be obtained from cheese milk with 1.5% fat. SD

1983

Vivier (D), Rivemale (M), Reverbel (JP) and Ratomahenina (R). **Study of the growth of yeasts from feta cheese.** *International Journal of Food Microbiology* 22(2/3); 1994; 207-215

Effects of various physicochemical parameters (pH, NaCl content,  $a_w$  in the medium and temp.) on the growth of *Kluyveromyces fragilis*, *Candida glabrata* and *K. thermotolerans* yeast strains were investigated. Growth rate of all yeast strains were identical for pH values ranging from 2.5-7.5, and the growth rate were not significantly affected by pH variations. Suitable growth was obtained at temp. of 4-44°C, and optimal temp. for growth was 32°C for all strains. Growth of yeasts were modified by increasing NaCl or decreasing  $a_w$  in the medium. SRA

## Milk powder

1984

Joosten (HMLJ), Van Dijk (WGFM) and Van der Velde (F). **Evaluation of motility enrichment on modified semisolid Rappaport-Vassiliadis medium (MSRV) and automated conductance in combination with Rambach agar for Salmonella detection in environmental samples of a milk powder factory.** *International Journal of Food Microbiology* 22(2/3); 1994; 201-206

## Paneer

1985

Zanjad (PN) and Mathur (BN). **Storage related changes in the  $\alpha$ -ion-exchange chromatographic and electrophoretic profile of casein in model sterilized paneer system.** *Indian Journal of Dairy Science* 47(2); 1994; 125-128

The extent of changes in various casein fractions during storage (for 0, 30 and 60 days) at ambient (35°C) and accelerated temp. (45°C) was evaluated using ion-exchange chromatography (IEC) and electrophoretic profile (EP) IEC of paneer revealed differences in the profile of various casein components. In conc. milk Paneer (CMP) the  $\alpha$ - and  $\beta$ -casein fractions appeared to be homogeneous;

whereas ultra filtered paneer (UFP) 2 components were associated with  $\alpha$ -casein and 3 components with  $\beta$ -casein. The densitometric pattern of casein indicated that the casein of both the products resolved into  $\beta$ -casein and  $\alpha$ -casein bands. Upto 60 days of storage no change was observed in the relative area of  $\beta$ -casein of CMP stored at both the temp. In UFP the relative area of  $\beta$ -casein increased while decrease in the area of  $\alpha$ -casein were observed at the end of the storage. SRA

## Wheys

1986

Mahmoud (R) and Savello (PA). **Solubility and hydrolyzability of films produced by transglutaminase catalytic crosslinking of whey protein.** *Journal of Dairy Science* 76(1); 1993; 29-35

Transglutaminase (TG) was used to crosslink covalently concentrated protein solutions of  $\alpha$ -lactalbumin and  $\beta$ -lactoglobulin and a 1:1 (w/w) mixture of these 2 proteins to form gels. Gels were dehydrated to produce films. Solubility of films incubated at room temp. for 24 h in buffered solvents indicated that there was a significant relationship with glycerol concn. in the film mixture and with the pH of the buffered solvent. Films were insoluble in SDS and  $\beta$ -mercaptoethanol. A significant relationship between solubility of all films and guanidine hydrochloride and urea in the solvent was observed. Films incubated with trypsin and  $\alpha$ -chymotrypsin produced a significant correlation between film hydrolyzability and incubation time. Using of TG-crosslinked whey protein as a film or food coating material, the pH and enzymic nature of the coated food surface should be considered. BV

1987

Gauthier (SF), Paquin (P), Pouliot (Y) and Turgeon (S). **Surface activity and related functional properties of peptides obtained from whey proteins.** *Journal of Dairy Science* 76(1); 1993; 321-328

Whey proteins are less surface-active than caseins, mainly because of their globular structure. Although their solubility

characteristics are good, their ability to stabilize emulsions and foams is poor, and this limits their use as food ingredients. Applications of enzymic hydrolysis to improve surface properties of whey protein are reviewed. Peptides produced by proteolysis are smaller, have less secondary structure than proteins and are expected to have different behaviour at oil-water or air-water interfaces. Recent advances in the understanding of the factors controlling surface properties of peptides are given. A 2-step ultrafiltration process is described that allows the production of a whey peptide fraction with improved interfacial and emulsifying properties. This peptide fraction was obtained from whey protein concentrate by the combination of heat treatment under acidic conditions, trypsin hydrolysis and ultrafiltration of the hydrolysates. Large mol. wt. and intact hydrophobic areas of whey peptides are presumed to be associated with the improvement of functionality of hydrolysates. Results concerning food applications of this fraction are presented. 211 references. AA

## Milk proteins

1988

Haque (ZU). **Influence of milk peptides in determining the functionality of milk proteins: a review.** *Journal of Dairy Science* 76(1); 1993; 311-320

Effects of amphipathic peptides on the functional properties of milk proteins are reviewed under the following headings: Interfacial properties of surface-active solutes (interfacial tension, creaming and drainage, protein displacement, phase behaviour of amphipathic peptides); and Functional properties (effect of amphipathic peptides from whey, enzymatic hydrolysis of milk proteins, improvement of dispersibility, thermostability of hydrolysates, oil-holding capacity). It is concluded that amphipathic peptides influence functionality of milk proteins primarily by affecting their surface activity and colloidal properties. 72 references. BV

1989

Fiat (AM), Migliore-Samour (D), Jolles (P), Drouet (L), Bal (DSC), Caen (J). **Biologically**

**active peptides from milk proteins with emphasis on two examples concerning antithrombotic and immunomodulating activities.** *Journal of Dairy Science* 76(1); 1993; 301-310

Physiologically active peptides derived from milk proteins are discussed. Opioid peptides; Antihypertensive peptides; Immunostimulating peptides; Casein phosphopeptides; Antithrombotic peptides; and Peptides with other physiological properties are the aspects covered. It is concluded that these peptides may have applications as food additives. BV

## Caseins

1990

Kumosinski (TF), Brown (EM) and Farrell (HMcJr). **Three-dimensional molecular modeling of bovine caseins: an energy-minimized beta-casein structure.** *Journal of Dairy Science* 76(4); 1993; 931-945

To obtain a molecular basis for the similarities and dissimilarities in the functional, chemical and biochemical properties between beta-casein and the other caseins, a predicted 3-dimensional model is presented. The predicted structure was assembled using molecular modelling techniques and secondary structural prediction algorithms, in conjunction with global secondary structural information from Raman spectroscopy. The structure was refined using energy minimization techniques to diminish the likelihood of structural overlaps and energetically unfavourable van der Waals contacts arising from the large number of proline residues present in the beta-casein sequence. The refined model showed a loosely packed asymmetrical structure with an axial ratio of 2:1. Hydrophobic side chains were uniformly dispersed over one end (C terminal) and the centre surface of the structure; the other end (N terminal) was hydrophilic. The hydrophobic section also possessed a large loop through which water could easily travel. Such a suprasurfactant structure may account for the micellar type of hydrophobically driven self-association exhibited by beta-casein. Other chemical and biochemical data were in good agreement with the refined structure. AA

## MEAT AND POULTRY

### Meat

1991

Hanninen (M-L). **Occurrence of *Aeromonas* spp. in samples of ground meat and chicken.** *International Journal of Food Microbiology* 18(4); 1993; 339-342

In this study, all ground meat samples (GMS 16/16) and 94% (15/16) of chicken samples (CS) were contaminated. The dominated species in GSM were *Aer. hydrophila* and *Aer. caviae*. In CS, *Aer. sobria* was common while *Aer. caviae* was isolated infrequently. Although *Aer. hydrophila* was isolated from 75% of GSM and 62% of CS, DL-lactate-positive *Aer. hydrophila* (genospecies 1) was isolated from only 25 or 37% of respective samples. Sorbitol-positive *Aer. hydrophila* (genospecies 3) was common in both GSM and CS. SRA

1992

Hudson (JA) and Mott (SJ). **Presence of *Listeria monocytogenes*, motile aeromonads and *Yersinia enterocolitica* in environmental samples taken from a supermarket delicatessen.** *International Journal of Food Microbiology* 18(4); 1993; 333-337

Environmental swab samples collected on 3 occasions from a supermarket delicatessen were examined for the presence of *Listeria monocytogenes*, motile aeromonads and *Yersinia enterocolitica*. Strains of *Y. enterocolitica* belonging to a pathogenic biotype were not recovered, but isolates of *L. monocytogenes* and motile aeromonads were found. Contaminated surfaces and items that came into direct contact with ready-to-eat food included a slicing machine, a knife and parsley that was to be used as a garnish. Most sites sampled near a display of processed meats requiring cooking, such as bacon and sausages, yielded positive results and could therefore act as a source of cross contamination for ready-to-eat meats. AA

1993

Farber (JM) and Daley (E). **Presence and growth of *Listeria monocytogenes* in naturally-contaminated meats.** *International Journal of Food Microbiology* 22(1); 1994; 33-42

A total of 101 pate samples representing 25 different types were examined for presence of *L. monocytogenes*. 7 of these samples were positive for *L. monocytogenes*, with 12 containing *L. innocua* and 1 each *L. welshimeri* and *L. ivanovii*. These naturally contaminated pates was assessed during 3 wk of storage at 4 C. Similar findings were noted with growth studies done with *L. monocytogenes* on naturally-contaminated wieners, ham and turkey breast. Very low numbers (< 10 cfu/g) of the organisms were found initially on these products with *L. monocytogenes* being found capable of surviving for long periods at 4 C, but being incapable of multiplying. Similarly, pates artificially-inoculated with *L. monocytogenes* showed survival but not growth of the organism over a 3 wk storage period at 4 C. SRA

1994

Rodriguez (JM), Sobrino (OJ), Moreira (WL), Fernandez (MF), Cintas (LM), Casaus (P), Sanz (B), Hernandez (PE). **Inhibition of *Listeria monocytogenes* by *Lactobacillus sake* strains of meat origin.** *Meat Science* 38(1); 1994; 17-26

This study indicated that strains of *Lact. sake* (23 and 148) are effective to inhibit the growth of *L. monocytogenes* in mixed cultures at various (15, 24 and 32°C) temp. Lactic acid bacteria could contribute, along with other factors, to avoid *L. monocytogenes* health hazards in foods. *Lact. sake* 23 is a stronger lactic acid producer than *Lact. sake* 148, a bacteriocinogenic strain. SRA

1995

Van Roon (PS), Houben (JH), Koolmees (PA), Van Vliet (T) and Krol (B). **Mechanical and microstructural characteristics of meat doughs, either heated by a continuous process in a radio-frequency field or conventionally in a waterbath.** *Meat Science* 38(1); 1994; 103-116

1996

Webb (EC), Casey (NH) and Van Niekerk (WA). **Fatty acids in the subcutaneous adipose tissue intensively fed SA mutton Merino and Dorper wethers.** *Meat Science* 38(1); 1994; 123-131

Recent ambiguity about the role of animal fat in causing coronary heart disease, coupled with the controversy regarding the effect of various levels of energy nutrition on ruminant depot fats, prompted an investigation into the influence of high-energy nutrition, breed and slaughter wt. on the fatty acid profiles of ruminants. Two isonitrogenous and isomineral diets containing 11.76 MJ ME/kg DM and 10.18 MJ ME/kg DM were fed to Dorper and SA Mutton Merino wethers of plus or minus 20 kg to 37 and 43 kg live wt. Subcutaneous fat samples and feed samples were collected for fatty acid analysis. Treatment significantly affected the subcutaneous fatty acid profiles of wethers, which includes C15:0, C16:0, C17:0, C17:1, C18:0, C18:1, C18:2 and C18:3. Treatment also influenced the concn. of saturated and unsaturated fatty acids in the subcutaneous adipose tissue as well as the concn. of trans-fatty acids. The results obtained suggest that dietary energy levels may significantly affect the fatty acids in the subcutaneous fat of wethers. Breed differences, after correcting for carcass fatness, occurred in C16:0. AA

1997

Whipple (G), Koohmaraie (M) and Arbona (JR). **Calcium chloride in vitro effects on isolated myofibrillar proteins.** *Meat Science* 38(1); 1994; 133-139

The effects of 30 mM CaCl<sub>2</sub> on the solubilization of structural proteins that contribute to myofibril stability was studied. Results (SDS-PAGE) indicated that myosin heavy chain, M-protein, C-protein,  $\alpha$ -actinin, actin, troponin-I and 72, 70, 62, 33, 32, 30 and 22 kDa unidentified bands were solubilized from myofibrils incubated in KCl buffer for 72 h. The addition of CaCl<sub>2</sub> hastened the appearance of some of the proteins in the supernatant fractions, but no differences were observed at 72 h among the treatments. SRA

1998

Ponce (E), Linforth (R), Hall (M), Guerrero (I) and Taylor (AJ). **Stability of haem pigments in model systems and cooked meat.** *Meat Science* 38(1); 1994; 141-151

1999

Abraham (J) and Varadarajulu (P). **Species identification and detection of adulteration level in cooked meat using agarose isoelectric focusing.** *Indian Journal of Animal Science* 63(2); 1993; 212-217

A study was undertaken to assess the feasibility of using agarose isoelectric focusing technique for species identification in binary mixtures of urea extracts from cooked meat and to assess the adulteration level in such mixture. Distinguishable differences were observed on AGIEF pherograms at pH 5.0-8.0. Even after subjecting the meat to a temp. of 120°C, species origin could be identified in binary mixtures based on the focal points of their protein bands compared to the focal points of authentic single species band profile. It was also possible to detect 10% level of adulteration by AGIEF in binary mixtures of cooked meat urea extracts. AA

## Beef

2000

Ziauddin (KS), Mahendrakar (NS), Rao (DN), Ramesh (BS) and Amla (BL). **Observations of some chemical and physical characteristics of buffalo meat.** *Meat Science* 37(1); 1994; 103-113

Proximate composition, sarcoplasmic and myofibrillar protein fractions of buffalo meat were similar to those of beef. Buffalo meat was also rich in lysine. Meat from young animals had a lower collagen content than that from old ones. As the temp. of holding the carcasses was increased, the rate of pH fall was faster. Meat from stressed animals showed a higher ultimate pH. Percentage of cooking loss and thermal shrinkage was higher in muscles of old animals than in young ones, which probably reflected the poor condition of the older animals. Meat cooked by pressured cooking showed lower Warner-Bratzler shear values as

compared with meat cooked in boiling water.  
AA

2001

Gill (CO) and Mc Ginnis (C). **Changes in the microflora on commercial beef trimmings during their collection, distribution and preparation for retail sale as ground beef.** *International Journal of Food Microbiology* 18(4); 1993; 321-332

2002

Lanari (MC), Cassens (RG), Schaefer (DM) and Scheller (KK). **Effect of dietary vitamin E on pigment and lipid stability of frozen beef. A kinetic analysis.** *Meat Science* 38(1); 1994; 3-15

2003

Vestergaard (M), Sejrsen (K) and Klastrup (S). **Growth composition and eating quality of *Longissimus dorsi* from young bulls fed the  $\beta$ -agonist cimaterol at consecutive development stages.** *Meat Science* 38(1); 1994; 55-66

2004

Hildrum (KI), Nilsen (BN), Mielnik (M) and Naes (T). **Prediction of sensory characteristics of beef by near-infrared spectroscopy.** *Meat Science* 38(1); 1994; 67-80

2005

Di Falco (G), Giaccone (V), Amerio (GP) and Parisi (E). **A modified impedance method to detect *Salmonella* spp. in fresh meat.** *Food Microbiology* 10(5); 1993; 421-427

2006

Hudson (JA) and Mott (SJ). **Growth of *Listeria monocytogenes*, *Aeromonas hydrophila* and *Yersinia enterocolitica* on cooked beef under refrigeration and mild temperature abuse.** *Food Microbiology* 10(5); 1993; 429-437

## Mutton

## Goat

2007

Lu (CD). **Implication of feeding isoenergetic diets containing animal fat on milk composition of alpine does [goats] during early lactation.** *Journal of Dairy Science* 76(4); 1993; 1137-1147

Lactation and digestion trials were conducted to test the hypothesis that supplemental animal fat in goat (does) diets would alleviate low fat content and decrease concn. of fatty acids responsible for flavour problems in goats' milk during early lactation. In a 17-wk trial, 14 Alpine female goats were assigned randomly to isonitrogenous and isoenergetic diets with either 0 or 5% animal fat in a double crossover experiment. Milk fat content was higher in females fed 5% fat (3.8 vs. 3.1%). Yields of 4% fat corrected milk and solids corrected milk were similar between treatments. No differences were observed in milk cholesterol content as a result of dietary animal fat. Caproic, caprylic, capric, lauric and myristic acids were lower, whereas palmitic, stearic and oleic acids were higher, in milk from females fed 5% fat. Results indicated that an intake of animal fat combined with high fibre contributed to changes in fat content and fatty acid composition in goats' milk. BV

## Sheep

2008

Biss (ME) and Hathaway (SC). **Performance characteristics of 3 different pre-evisceration wash regimes applied to the forequarters of ovine carcasses in an inverted dressing system.** *Meat Science* 38(1); 1994; 81-90

## Pork

2009

Jeremiah (LE), Ball (RO), Merrill (JK), Dick (P), Stobbs (L), Gibson (LL), Uttaro (B). **Effects of feed treatment and gender on the flavour and texture profiles of cured and uncured pork cuts. I. Rectopamine treatment and dietary protein level.** *Meat Science* 37(1); 1994; 1-20

2010

Jeremiah (LE), Merrill (JK), Stobbs (L), Gibson (LL) and Gibson (R). **Effect of feed treatment and gender on the flavour and texture profiles of cured and uncured pork cuts. II. Rectopamine treatment and dietary protein source.** *Meat Science* 37(1); 1994; 21-35

2011

Jeremiah (LE), Ball (RO), Merrill (JK), Gibson (LL), Dick (P), Stobbs (L), Uttaro (B). **The effects of feed treatment and gender on the flavour and texture profiles of cured and uncured pork cuts. III. Effects of gender.** *Meat Science* 37(1); 1994; 37-54

2012

Robe (GH) and Xiong (YL). **Kinetic studies of the effect of muscle fiber type and tripolyphosphate on the aggregation of porcine salt-soluble proteins.** *Meat Science* 37(1); 1994; 55-65

2013

Boers (RH) and Dijkmann (KE). **Shelf-life of vacuum-packaged wild boar meat in relation to that of vacuum-packaged pork: Relevance of intrinsic factors.** *Meat Science* 37(1); 1994; 91-102

2014

Fernández (X), Forslid (A) and Tornberg (E). **The effect of high post-mortem temperature on the development of pale, soft and exudative pork: Interaction with ultimate pH.** *Meat Science* 37(1); 1994; 133-147

## Pig

2015

Karlsson (A), Essen-Gustavsson (B) and Lundström (K). **Muscle glycogen depletion pattern in halothane-free pigs at slaughter and its relation to meat quality.** *Meat Science* 38(1); 1994; 91-101

## Products

2016

Parolari (G), Virgili (R) and Schivazappa (C). **Relationship between cathepsin B activity**

**and compositional parameters in dry-cured hams of normal and defective texture.** *Meat Science* 38(1); 1994; 117-122

2017

Walls (I), Cooke (PH), Benedict (RC) and Buchanan (RL). **Factors affecting attachment of *Salmonella typhimurium* to sausage casings.** *Food Microbiology* 10(5); 1993; 387-393

The mechanisms responsible for attachment of *Salmonella* casings as a means of gaining insights into adherence of pathogenic bacteria to meat tissues was investigated. Potential inhibitors (glucose, galactose, hyaluronin, chondroitin sulphate, Tween 20, EDTA, gelation, glycine and bovine albumin) had no effect on the growth of *Salmonella typhimurium* cells. Solubilized collagen significantly ( $P < 0.05$ ) inhibited attachment. NaCl at concn. range of 25-100 mgml<sup>-1</sup> had little effect on bacterial attachment. Increasing NaCl levels to > 50 mgml<sup>-1</sup> decreased bacterial number of 0.5 log. Rate of attachment of irradiated cells was similar to non-irradiated cells. SRA

## Sausages

2018

Stahnke (LH). **Aroma components from dried sausages fermented with *Staphylococcus xylosus*.** *Meat Science* 38(1); 1994; 39-53

This study showed that sausages fermented with *Staph. xylosus* contained several fragment esters that were not found in control sausages without microbial growth. Control sausages had an unpleasant, rancid odour compared to sausages with *Staph. xylosus*, indicating that the esterase activity of *Staph. xylosus* or other microorganisms is very important in order to obtain the proper fermented sausage aroma. SRA

2019

McCarthy (JA) and Damoglou (AP). **The effect of low-dose gamma irradiation on the yeasts of British sausage.** *Food Microbiology* 10(5); 1993; 439-446

The effect of low-dose gamma irradiation (1.5 and 3 kGy) on the yeasts of British fresh sausage was investigated. Irradiation had a significant lethal effect on yeast numbers and also affected the composition of the yeast microflora of sausages containing sulphite preservative (S) and unsulphited (US) sausages. Levels of radiation resistance differed between yeast genera. *Trichosporon* spp. (in particular *T. cutaneum*) demonstrated greatest radiation resistance, and dominated the initial microflora of both US and S samples irradiated to a dose of 3 kGy. After storage at 4 C for 7 and 14 days. *Trichosporon* spp. were isolated from irradiated (3kGy) US samples but not from irradiated (3 kGy) S samples. In contrast, *Debaryomyces* spp. were greatly reduced in number by a 1.5 kGy treatment and were only isolated from unirradiated samples after storage at 4 C for 7 and 14 days. *Candida* spp. (in particular *C. zeylanoides*) constituted the major microfloral component of both types of sausage initially and persisted after an irradiation dose of 3 kGy, suggesting that they may possess an inherent resistance to irradiation ( $D_s$  3.3 kGy,  $D_{10}^{sig}$  0.3 kGy). Of the yeast strains studied, *Sporobolomyces roseus* exhibited least radiation resistance. After 14 days storage at 4 C, no significant differences between, the numbers of yeasts in unirradiated S samples and 1.5 kGy US samples were found, indicating that low-dose irradiation may serve as an alternative treatment to sulphite preservation for suasages. AA

## Poultry

### Chickens

2020

Brah (GS), Chaudhary (ML) and Sandhu (JS). **Inter-strain variation and distribution stability for physical egg-quality and egg component characters in chicken.** *Indian Journal of Animal Science* 63(9); 1993; 984-988

Selected strains (PL 1 and PL 2) and 1 control line (PL 3) of white leghorns were evaluated for several egg-quality traits at 70 wks of age. Strains PL 2 with higher egg production, body wt. and egg wt. compared to PL 1, was characterized by better shell-quality but poorer albumen quality. The control line with lower egg production, body and egg wt. did not differ

from PL 2 for egg quality traits. The portion of yolk, albumen and shell were similar for the 3 lines. Small departures from the normality of distribution were observed for some of the egg-quality traits. AA

2021

Babji (AS) and Kee (GS). **Changes in colour, pH, WHC, protein extraction and gel strength during processing of chicken surimi (Ayami).** *ASEAN Food Journal* 9(2); 1994; 63-68

The effects of processing (grinding and 3 washings) on pH, colour, water holding capacity (WHC), protein extractability and gel strength of 18 months old Rhode Island Red broiler, chicken and 2 months old Arbor Acre chickens (spent hens) meat were measured. Processing reduced sarcoplasmic proteins, but increased extractable salt soluble proteins at 7.5, 4.2 and 7.3% for broiler meat and 5.3, 5.8 and 5.1% for chicken meat for 1, 2 and 3 washings respectively. pH was increased from 5.7 to 6.3 for both meats. Broiler meat had a higher WHC than spent hen. The colour showed increase in lightness and redness but decrease in yellowness. Washing produced desirable gel in both broiler chickens. SRA

### Quails

2022

Shrivastav (AK) and Panda (B). **Influence of levels of various fat sources on the performance and carcass composition of quail broilers.** *Indian Journal of Animal Science* 63(9); 1993; 993-997

Quail chicks reared on same starter diet upto 2 wks were offered 9 finisher diets (L) from 3 to 5 wks containing 2 sources of fat (G.N. oil and beef tallow), 2 levels of inclusion (2.5 and 5%) and 2 energy levels (2750 and 2900 Kcal ME/kg) in a factorial design along with one control without fat to determine the effects of various dietary regiment at 5 wks of slaughter age in quail broilers. Quails were more efficient in utilizing G.N. oil than beef tallow in terms of body wt. gain, feed efficiency and energy retention. Dressing yield and abdominal fat content were not altered by dietary variables. Content and iodine number of the carcass fat

were significantly higher in the groups which received G.N. oil in their diet. AA

## SEAFOODS

### Products

#### Eggs

2023

Pandey (NK), Anand (SK) and Verma (SS). **Effect of cooking methods on the peeling characteristics and quality of hard cooked eggs.** *Indian Journal of Animal Science* 63(1); 1993; 74-79

Peeling characteristics and quality of hard cooked eggs were investigated in intact and drilled eggs cooked by one of the following methods: hot water (HW) (eggs were held for 25 min in warm water after boiling), severe boiling (SB) for 20 min, steaming (Si) at ambient pressure for 20 min, and simmering (S) at 85 C for 20 min. Ease for peeling and peeled surface appearance were significantly better for 'SB' eggs followed by 'St' eggs in intact group. Drilling resulted in greater incidence of shell cracks and lower peeling scores. Eggs cooked by water cooking methods had darker greening of yolk surface than in steam-cooked eggs. A greater decline in albumen pH was recorded in 'SB' and 'St' eggs than in others. Cooking methods brought about significant reduction in aerobic plate counts of shell surface and egg contents; however, max. reduction was obtained by steaming. Intact 'SB' eggs had more acceptable sensory profile of albumen and yolk whereas drilled eggs had slightly non-characteristic odour and harder egg whites than intact ones. AA

2024

Chandan (V), Fraserm (DE), Brooks (BW) and Yamazaki (H) **Simple extraction of Campylobacter lipopolysaccharide and protein antigens and production of their antibodies in egg yolk.** *International Journal of Food Microbiology* 22(2/3); 1994; 189-200

The present paper describes a simple and safe method for preparing solid-free *Campylobacter* antigens and the economical preparation of antibodies to the *Campylobacter* antigens in chicken egg yolks. BV

2025

Ramachandran (A). **A simple priority rule for processing in seafood processing plants.** *Seafood Export Journal* 25(19); 1994; 7, 9, 11, 13-14

The usual priority rules viz., first come first worked on; first come, first worked on but with dollar value classes; choose the one to work on next, etc., could not operate successfully for seafood processing. So a two stage scoring system based on the purchase price and waiting time tolerance of the raw materials (fishes) is used to develop a new priority rule for processing different raw materials. Eg., let the purchase rate/kg of raw material upto Rs. 3.00 be assigned a score of 1, above Rs. 3.00 and upto Rs. 5.00 score of 2 and so on. Let the range of tolerance limit for above 45 h be assigned a score of 1, above 40 h and upto 45 h score of 2 and so on. The sum of scores for both the factors to a particular raw material decides the priority. i.e. Max. total score, raw material should be processed first and the one having next higher total score, second and so on. SD

2026

Bhaskaran Nair (P). **ISO 9000 quality system for marine products industry - selection and use of the relevant standard.** *Seafood Export Journal* 25(19); 1994; 31, 33, 35, 37

ISO 9000 family of standards envisages meeting the requirements of customers as quality management system. This describes quality system requirements; not product requirements; and does not prescribe how to achieve the objective, but leaves the choice to the management to achieve the same by 'stakeholder motivate' or 'management motivated' models. The stake holders are 5 group viz., buyers/customers; employees; suppliers of raw materials, etc; society such as pollution control, etc; and supplier as owner. Management motivated model comprises of guidance for quality management; for contractual between supplier/manufacturer/producer and buyer/customer;

for buyer/customer registration and for certification by an accredited body. For marine products industry ISO 9002 is the appropriate model and ISO 9003 for small or medium size company. SD

## Mussels

2027

Shiny Sreedhar (K) and Radhakrishnan (CK). **Musculista senhausia - a new mussel resource from Cochin backwaters.** *Seafood Export Journal* 25(19); 1994; 27, 29

The nutritive value of *Musculista senhausia* (Benson) a new mussel, was evaluated in total tissues, mantle-gonad and foot. Glycogen varied from 25.7 to 12.93 µg/mg and lipid from 26.60 to 18.22 µg/mg. But in larger groups protein varied from 56.61 µg/mg and glycogen to 40.8 µg/mg. *M. senhausia* was found not at all inferior to any other seafood in nutritional point of view. This high protein resource which is used for manure or duck feed, can be incorporated in several preparations like sausages, pickles, etc., and for the preparation of protein concentrate and fish meal as well. GS

## Prawns

2028

Sherief (PM) and Xavier (T). **Nutrient composition of hepatopancreas from *Macrobrachium rosenbergii* and *Penaeus indicus*.** *Seafood Export Journal* 25(19); 1994; 17, 19, 21-22

Nutrient composition of hepatopancreas from the fresh water prawn *Macrobrachium rosenbergii* and the marine prawn *Penaeus indicus* is studied. Hepatopancreas forms 4.22 and 3.96% of the total wt. of *M. rosenbergii* and *P. indicus* respectively. Lipid is found to be the major nutrient of the hepatopancreas. Also it has a high content of non-protein nitrogenous compounds especially free amino acids, carotenoids and Fe. Though it has a high fat content, it is low in cholesterol. The possibility of using hepatopancreas for formulating energy rich maturation feeds for prawn and fish and also as a sweetening and colouring agent in foods are discussed. AA

## Fish

2029

Joseph (KO) and Srivastava (JP). **Mercury in finfishes and shellfishes inhabiting Ennore estuary, Madras.** *Fishery Technology* 30(2); 1993; 115-118

The concn. of Hg in some commercially important finfishes and shellfishes from Ennore estuary which receives effluent from a chlor-alkali plant was measured. The concn. registered in finfishes (*Chanos chanos* and *Liza macrolepis*), prawn (*Penaeus indicus*) and edible oyster (*Crassostrea madrasensis*) posed no imminent threat to the human consumers to the biota themselves. The distribution of Hg load exhibited seasonality, the higher values being observed during monsoon period in all the organisms. The Hg level observed in the biota was oyster > prawn > finfishes. Oyster, *C. madrasensis* is found suitable as a sentinel organism for monitoring mercury contamination in estuaries. AA

## Sardines

2030

Cavestany (M), Colmenero (FJ), Solas (MT) and Carballo (J). **Incorporation of sardine surimi in bolonga sausage containing different fat levels.** *Meat Science* 38(1); 1994; 27-37

This study was conducted to assess the effects produced on binding properties, texture and microstructure by incorporations of 0, 6.5, 13 and 20% sardine surimi as an ingredient in bolonga sausage containing 4.8, 10.6 and 20.8% levels of fat. When the fat levels was reduced, the binding properties, shear force ( $p < 0.01$ ) and penetration force ( $p < 0.03$ ) of the products declined. The incorporation of surimi produced scarcely any alteration in the fat and water binding properties and rheological characteristics of the meat products. SRA

## Products

2031

Jeppesen (VF) and Huss (HH). **Characteristic and antagonistic activity of lactic acid**

**bacteria isolated from chilled fish products.** *International Journal of Food Microbiology* 18(4); 1993; 305-320

Sixtyone isolates of lactic acid bacteria from lightly preserved, chilled fish products were characterized with special emphasis on antagonistic activity and their use as starter cultures. The strains were phenotypically identified and characterized with regard to gas production, carbohydrate fermentation, production of off-odours, H<sub>2</sub>O<sub>2</sub> production, antagonistic activity and growth at 2.5 and 10 C. Growth at 10 C was detected for all strains within 4 days. At 5 C, 90% of the isolates grew within 3-9 days. At 2 C only 33% of strains grew within 9 days. Two strains, viz., *Leuconostoc* spp (V6) and *Lactobacillus plantarum* (LKE5) were found suitable for biopreservation of fish products. SRA

## Sauce

2032

Minoza-Gatchalian (M), Palomares (T) and Contreras (E). **Sensory evaluation of fish sauce (patis).** *ASEAN Food Journal* 9(2); 1994; 55-61

Fish sauce (5 commercial brands) was evaluated by identification of sensory attributes and physico-chemical standards through a literature survey, followed by informal interviews and panel discussions with manufacturers and end-users. Sensory study showed no significant difference with respect to acceptability. The products were rated with more score for aroma. SRA

## PROTEIN FOODS

Nil

## ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES

### Alcoholic beverages

#### Wines

2033

Lonvaud-Funel (A) and Joyeux (A). **Antagonism between lactic acid bacteria of wines: Inhibition of *Leuconostoc aenos* by *Lactobacillus plantarum* and *Pediococcus pentosaceus*.** *Food Microbiology* 10(5); 1993; 411-419

In a preliminary study represents of the different bacterial speices isolated from grape musts and wines were tested for interaction during growth; 6 *Lactobacillus* sp., 1 *Pediococcus* sp., 3 *Leuconostoc* sp. The medium obtained after culture of different strains showed an inhibitory activity against other strains when it was added to fresh medium. Of the 10 strains belonging to 8 different species the most dramatic effect was caused by *P. pentosaceus* yq 791 and *L. plantarum* (LP) against *Lc. aenos* and *Lc. mesenteroides*. SRA

### Non-alcoholic beverages

#### Coffee

2034

Veena (UM), Suryaprakash (S) and Achoth (L). **Changing direction of Indian coffee exports.** *Indian Journal of Agricultural Economics* 49(3); 1994; 426-431

The dynamics of changing structure of Indian coffee, viz., production, international market, export value, is attempted with a view to enhance the same. The structural change in the share of exports is analysed through the first order Markov model and the transitional probability matrix is estimated. The results indicated that India could not retain its previous market share to USA, Netherlands, Yugoslavia and Italy even though exports to them increased. India has retained its market share to USSR, West Germany and others which showed preference to Indian coffee. To achieve sustenance of coffee export India should capture markets of Commonwealth of Independent states and other new world markets. The task may not be easy due to the break down of International Coffee Agreement and the cut-throat competition from the other exporting countries. SD

## Fruit juices

### Starfruit juices

2035

Rusul (G) and Ang (PY). **Keeping quality of pasteurised bottled starfruit juice preserved by sodium benzoate, sodium sorbate and sodium bisulphite.** *ASEAN Food Journal* 9(2); 1994; 77-82

The effects of sodium benzoate (SB) and sodium sorbate (SS) (0, 50, 100 and 150 mg/kg) and sodium bisulphite (SBS) (0, 25, 50 and 75 mg/kg) on the microbiological and chemical quality and colour of bottled starfruit juice were determined at 26-28°C room temp. Pasteurisation at 75°C for 20 min at pH 3.5 was effective in reducing initial browning. Browning occurred as storage proceeded juices with or without preservatives, occasionally < 10 cfu on plate count agar were detected and no moulds, yeasts or lactic acid bacteria were observed during 12 wks of storage. The changes in titratable acidity were negligible, but ascorbic content of juice in the presence of SB, SS and SBS decreased from 5.07, 4.17 and 4.70 mg/100 ml to 1.07, 1.20 and 1.22 mg/100 ml respectively, after being stored for 12 wk. Significant increase ( $P < 0.05$ ) in total soluble solids in juice during storage was also observed. SRA

### Tomato juice

2036

Sukhdev Singh and Saini (SS). **Concentrational changes in tomato juice of new hybrids.** *Research and Industry, India* 39(3); 1994; 170-174

Concentrational changes in tomato juice of 6 new high yielder cvs., Punjab chuhara, NH-15, NH-25, NH-2476, NH-3025 and NH-3027 registered a tangible increase in reducing sugars with marginal change in pH, acidity, pectin and tannin. Ascorbic acid was the max. sufferer with more pronounced losses (50.7%) in open vat than under vacuum (46.8%) evaporation. Lycopene remained almost constant, retaining native intense red colour of new hybrids in the resulting concentrates. AA

## Watermelon juices

2037

Saini (SPS) and Bains (GS). **Process for pilot-production of seed and ascorbic acid fortified watermelon juice.** *Research and Industry, India* 39(3); 1994; 147-149

Compositional and sensory qualities of juice from 2 new watermelon cvs., H-23 and Shipper with and without added ascorbic acid were studied. Bottled juice stored well over a period of 6 months under room temp. (12-40°C) and remained highly acceptable throughout. Improvement of insipid taste of fresh juice through sugar, acid adjustment was prerequisite to processing. Fortified juice showed losses of ascorbic acid during pasteurization, processing and storage. There is potential for commercial production and marketing of quality seed and vitaminized watermelon juice. AA

## FATS AND OILS

### Fats

2038

Harris (DW) and Day (GA). **Structure versus functional relationships of a new starch-based fat replacer.** *Starch/Staerke* 45(7); 1993; 221-226

The starch-based new fat replacer has an average mol. wt. of less than 20 000 and is composed of crystallites comprised of double helical structures. Based on actual particle size analyses and calculations made on surface area data, it is concluded that the creme is comprised of loosely aggregated submicron size particles. This is corroborated by TEM results. Oxygen  $^{17}$ NMR measurements demonstrate the importance of water immobilization during creme formation. Functional properties of the new starch based fat replacer are discussed in relation to its structure. BV

### Oils

2039

Buche (SD), Patil (MN) and Jaiswal (PK). **Detection of mahua oil in groundnut and**

**sesame oils.** *Journal of the Oil Technologists Association of India* 26(3); 1994; 83

A simple TLC method is developed to detect the presence of 5% or more mahua oil in groundnut and sesame oils. The unsaponifiable matter was extracted and developed on silica gel G plates with benzene-diethyl ether-cyclohexane-chloroform (2:3:2:1). Interference is observed in the presence of other oils. AA

2040

Rath (SP) and Srinivasulu (C). **Fatty acid composition of banyan fruit oil.** *Journal of the Oil Technologists Association of India* 26(3); 1994; 84

Banyan fruit (including seeds) oil was dark brown, partially solidified after 2 days and became liquid at 54.5 C. The oil content is 4.2% and the oil is rich in palmitic acid (44.8%). % fatty acid compositions were: myristic 1.4; palmitic 44.8; stearic 3.5; oleic 26.4; linoleic 17.3 and linolenic 6.6. AA

### **Nigerseed oil**

2041

Nagaraj (G). **Effect of location on the fatty acid composition of nigerseed oil.** *Journal of the Oil Technologists Association of India* 26(3); 1994; 75-76

Niger seed samples from 8 locations in India were analysed for their fatty acid composition. Oleic to linoleic acid ratio showed wide variation with respect to location. Linoleic acid was higher (60-70%) when the mean max. (< 30°C) and min. (< 20°C) temp. were lower. At higher temp. oleic acid levels were higher (around 40%). AA

### **Palm oil**

2042

Lakshmi (B) and Sarojini (G). **Changes in carotenoids during storage and heating of red palm oil and its blends with groundnut oil.** *Journal of the Oil Technologists Association of India* 26(3); 1994; 81-82

The changes in total carotenoids in red palm oil (RPO) and in blended oils (70:30, 50:50, 30:70 ratios of RPO and groundnut oil) during storage and heating under normal household conditions are reported. The total carotene content of snack items deep fried in RPO and the blended oils were determined. There was 75% loss of total carotenoids from stored RPO. The loss of carotenoids from RPO when used for deep frying was 78%. The carotenoid content of deep fried snack item ('Muruku') was 2900 µg/100 g. The results obtained for the blended oils were similar to those obtained for RPO. AA

### **Rice bran oils**

2043

Sivala (K), Mukherjee (RK) and Bhole (NG). **A preliminary study of rice bran oil expression in a manually operated hydraulic press.** *Journal of Food Engineering* 20(3); 1993; 215-222

Mechanical pressing of rice bran using a 20 t hydraulic press, a promising alternative was investigated for producing edible grade oil at the rice mill site. A test-cell unit was designed in which bran sample sizes (50, 100, 150, 200, 250 g), holding times (15, 30, 45, 60 min) and compression loads (5, 8, 10, 12, 15 t) were studied. Optimum conditions for expression of oil from a bran sample size of 100 g were a pressure of 12.5 MPa (127 kg/cm<sup>2</sup>) for a holding time of 45 min, giving a max. oil yield of 45%. Resulting cake thickness was 10 mm; cake thicknesses > 10 mm gave a higher residual oil content in the cake. BV

## **SPICES AND CONDIMENTS**

### **Spices**

#### **Chillies**

2044

Hawer (WS), Ha (J), Hwang (J) and Nam (Y). **Effective separation and quantitative analysis of major heat principles in red pepper by capillary gas chromatography.** *Food Chemistry* 49(1); 1994; 99-103

An effective analytical method for the separation and quantitative analysis of the major heat principles in red pepper has been established. Capsaicinoids were extracted with acetone, and undesirable components, such as pigments, lipoids, and lipids were effectively removed by liquid-liquid fractionation to avoid interference of the chromatogram or contamination of the column. A moderately polar fused silica capillary column, bonded with cross-linked cyanopropyl phenyldimethyl siloxane, separated capsaicinoids with good resolution, and hydrogen eluted the components with in reasonable retention times. AA

## Pepper

2045

Sinharoy (S) and Nair (SR). **International trade and pepper price variations: A cointegration approach.** *Indian Journal of Agricultural Economics* 49(3); 1994; 417-425

The objectives whether the movements in international prices of Indian pepper reflects the variations in such prices of other economics and whether the domestic price of pepper moved synchronously with the international price were studied. The 'stylised facts' on pepper price movements in the international and domestic markets are presented. The monthly spot price series for India, Indonesia, and Brazil were checked by Dickey-Fuller and Augmented Dickey-Fuller methods for stationary. For international and domestic prices of pepper for India the dynamic equation was estimated by Engle-Granger two step procedure. Result showed that due to the open trade status for pepper, prices had moved synchronously indicating integration of world pepper market and that the domestic supply variables were responsive to international market conditions. SD

2046

Ferreira (SRS), Meireles (MAA) and Cabral (FA). **Extraction of essential oil of black pepper with liquid carbon dioxide.** *Journal of Food Engineering* 20(2); 1993; 121-133

Extraction of essential oil of black pepper [*Piper nigrum* L.] was studied in a fixed bed extractor with liquid CO<sub>2</sub> as solvent. Solubility of the oil in the solvent was determined using the dynamic method. Solubility of pepper oil varied from 0.07 plus/minus 0.01 to 0.10 plus/minus 0.04 kg oil/kg CO<sub>2</sub> at temp. ranging from 16 to 20°C and pressure from 6.35 to 7.35 MPa. Extraction yield was approx. 2.7%; 90% of oil was extracted during the constant rate period. Extraction kinetics were affected by temp. and pressure and strongly affected by solvent flow rate. Increased temp. and pressure, and decreased particle size and solvent flow rate, increased yield. Results indicate that subcritical essential oil extraction is a promising technology. AA

## Tamarind

2047

Sila Bhattacharya, Bal (S), Mukherjee (RK) and Suvendu Bhattacharya. **Functional and nutritional properties of tamarind (*Tamarindus indica*) kernel protein.** *Food Chemistry* 49(1); 1994; 1-9

Meal and concentrate from tamarind kernels (raw and roasted) were studied. Functional properties - N solubility index, water-absorption capacity, emulsifying capacity, foaming capacity and stability and nutritional properties - *in vitro* protein digestibility and amino acid composition was determined. Proteins were fractionated according to their solubility in water, salt sol., ethanol and NaOH sol. The *in vitro* digestibility was 71.3; the kernel was rich in lysine, glutamic acid, aspartic acid, glycine and leucine but deficient in S containing amino acids. SD

## SENSORY EVALUATION

2048

Rao (MA), Cooley (HJ), Ortloff (C), Chung (K) and Wijts (SC). **Influence of rheological properties of fluid and semisolid foods on the performance of a filler.** *Journal of Food Process Engineering* 16(4); 1993; 289-304

For low-viscosity (LV) foods, in a piston filler (FMC PN010), power-law relationships were found between the number of cycles/min at which splashing occurred on the rim of a container and viscosities of the test fluids. Splashing was due to either the breakup of a discharge jet in the nozzle or overflow of discharge fluid over the rim of a container. The formation of droplets due to breakup of discharge jets was confirmed by solution of the flow equations on a Cray-2 super computer. With foods containing particulates in a LV liquid, splashing occurred when the food hit the bottom of the container and again when the plunger hit the top of the heaped food. With foods having high magnitudes of yield stresses, the plug formed in the discharge nozzle of the filler contributed to heaping of the foods. BV

#### FOOD STORAGE

2049

Saikia (L), Dutta (PK) and Hazarika (K). **Storage behaviour of betel leaves as conditioned by petiolar regulation and storage material in different seasons.** *Indian Cocoa, Arecanut - Spices Journal* 17(1/2); 1993; 19-21

A trial conducted on storage behaviour of betel leaves of Bangla var. for 7, 14 and 21 days with petiolar regulation and 3 storage materials viz., wet straw, banana leaves and wet straw lining in bamboo basket at three season i.e. April-May, July-August and December-January revealed that depetiolation helped significantly to get lesser spoilage while banana leaves packing proved best over other and spoilage could be minimized. December-January was congenial for storage for longer period in which time a lean season of harvest occur while at peak of harvest i.e. July-August deterioration was min. in Assam condition. AA



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Choi (IW)	El Samragy (YA)	Gauthier (SF)
1969	1963	1987
Choudhury (B)	El-Zoghbi (M)	Genigeorgis (C)
1927	1928	1976
Chung (K)	Elfving (DC)	German (JB)
2048	1929	1858
Cintas (LM)	Elliott (JP)	Giaccone (V)
1994	1968	2005
Colmenero (FJ)	Ellis (PR)	Gibson (LL)
2030	1891	2009 2010 2011
Contreras (E)	Ellis (RP)	Gibson (R)
2032	1903	2010
Cooke (PH)	Ellis (WO)	Gill (CO)
2017	1916	2001
Cooley (HJ)	Emmons (DB)	Gilliland (SE)
2048	1977	1954
Cooper (JE)	Emuakpor (SMM)	Gilmour (A)
1879	1911	1879
Coulon (JB)	Ernstrom (CA)	Graybosch (RA)
1965	1977 1979	1898
Crosbie (GB)	Espinel (LA)	Grieve (RCJ)
1888	1960	1972
Cura (JA)	Essen-Gustavsson (B)	Gruber (M)
1909	2015	1882
Daley (E)	Every (D)	Guerrero (I)
1993	1890	1998
Damoglou (AP)	Eynard (L)	Gupta (RB)
2019	1957	1893
Daudin (JD)	Farber (JM)	Ha (J)
1857	1993	2044
Dawson (KA)	Fardiaz (D)	Ha (JK)
1955	1868	1970
Day (GA)	Farrell (HMJr)	Hadjikinov (D)
2038	1990	1864
Delhayé (S)	Fernandez (MF)	Halek (GW)
1883	1994	1848
Denter (J)	Fernandez (X)	Hall (M)
1919	2014	1998
Dhillon (GS)	Ferreira (SRS)	Hamaker (K)
1914	2046	1873
Di Falco (G)	Fiat (AM)	Hanninen (M-L)
2005	1989	1991
Dick (P)	Forslid (A)	Hansen (CL)
2009 2011	2014	1963 1979
Dijkmann (KE)	Frasern (DE)	Hansen (LE)
2013	2024	1898
Doyon (G)	Freeman (AE)	Haque (ZU)
1916	1966	1988
Drackley (JK)	Fu (FY)	Harris (DW)
1968	1851	2039
Drouet (L)	Gale (CM)	Hartel (RW)
1989	1979	1960
Dural (NH)	Gamisans (J)	Harvey (J)
1867 1947	1882	1879
Dutta (PK)	Gan (Z)	Harwig (J)
2049	1891	1877
Egele (PU)	Gao (L)	Haska (N)
1911	1920	1935 1937

<b>Hathaway (SC)</b> 2008	<b>Jayachandra (K)</b> 1900	<b>Klastrup (S)</b> 2003
<b>Hawer (WS)</b> 2044	<b>Jeon (IJ)</b> 1969	<b>Kon (H)</b> 1952
<b>Hayward (LJ)</b> 1872	<b>Jeppesen (VF)</b> 2031	<b>Kondjoyan (A)</b> 1857
<b>Hazarika (K)</b> 2049	<b>Jeremiah (LE)</b> 2000 2010 2011	<b>Koohmaraie (M)</b> 1997
<b>Hegarty (HM)</b> 1872	<b>Jolles (P)</b> 1989	<b>Koolmees (PA)</b> 1995
<b>Heldman (DR)</b> 1848	<b>Jones (E)</b> 1901	<b>Kouris (MD)</b> 1924
<b>Hernandez (CV)</b> 1866	<b>Joosten (HMLJ)</b> 1984	<b>Kovacs (MIP)</b> 1892
<b>Hernandez (MT)</b> 1931	<b>Joseph (KO)</b> 2029	<b>Krause (I)</b> 1971
<b>Hernandez (PE)</b> 1994	<b>Joyeux (A)</b> 2033	<b>Krisman (CR)</b> 1909 1910
<b>Hicks (CL)</b> 1964	<b>Kamaliya (KB)</b> 1945	<b>Krol (B)</b> 1995
<b>Hildrum (KI)</b> 2004	<b>Kanbe (C)</b> 1918	<b>Krusell (L)</b> 1878
<b>Hill (JP)</b> 1967	<b>Kannappan (K)</b> 1942	<b>Kubik (S)</b> 1933
<b>Hines (AI)</b> 1867 1947	<b>Kapseu (C)</b> 1943	<b>Kudo (K)</b> 1881
<b>Horikoshi (K)</b> 1881	<b>Karamathullah (G)</b> 1942	<b>Kumagai (H)</b> 1847 1847
<b>Hotchkiss (JH)</b> 1980	<b>Karlsson (A)</b> 2015	<b>Kumaraswamy (K)</b> 1942
<b>Houben (JH)</b> 1906 1995	<b>Kasrazadeh (M)</b> 1976	<b>Kumosinski (TF)</b> 1990
<b>Houhouigan (DJ)</b> 1906	<b>Katsiari (MC)</b> 1982	<b>Lacroix (C)</b> 1977
<b>Howes (NK)</b> 1892 1899	<b>Kauten (RJ)</b> 1858	<b>Lakshmi (B)</b> 2042
<b>Huang (S)</b> 1948	<b>Kawaguchi (A)</b> 1952	<b>Lal (U)</b> 1944
<b>Hudson (JA)</b> 1992 2006	<b>Kee (GS)</b> 2021	<b>Lambe (WJ)</b> 1888
<b>Huhtanen (P)</b> 1962	<b>Keshinro (OO)</b> 1911	<b>Lammers (G)</b> 1936
<b>Hurley (WL)</b> 1972	<b>Keys (MM)</b> 1904	<b>Lanari (MC)</b> 2002
<b>Huss (HH)</b> 2031	<b>Khalatkar (AS)</b> 1862	<b>Landry (J)</b> 1883
<b>Hwang (J)</b> 2044	<b>Khan (K)</b> 1893	<b>Lang (W)</b> 1887
<b>Iyer (TSG)</b> 1875	<b>Kimura (T)</b> 1870	<b>Lanzanova (M)</b> 1973
<b>Jacobsen (JV)</b> 1904	<b>Kiranoudis (CT)</b> 1924	<b>Launay (B)</b> 1957
<b>Jaiswal (PK)</b> 2039	<b>Kirov (SM)</b> 1872	<b>Lauro (M)</b> 1905
<b>Jane (J)</b> 1934 1939	<b>Kishore (P)</b> 1912	<b>Lehr (FM)</b> 1850
<b>Javanainen (P)</b> 1949	<b>Klaenhammer (TR)</b> 1958	<b>Leisle (D)</b> 1892

Leopardi (E)	Maroulis (ZB)	Mott (SJ)
1886	1924	1992 2006
Lickly (TD)	Marshall (DL)	Mucchetti (G)
1850	1871	1973
Lindberg (GL)	Martinez (OLA)	Mukherjee (RK)
1966	1861	2043 2047
Lindsay (RC)	Marty (G)	Naes (T)
1970	1965	2004
Linforth (R)	Masoje (P)	Nagaraj (G)
1998	1899	2041
Linko (P)	Math (RG)	Nagendra Shah
1905	1921	1874
Linko (YY)	Mathur (BN)	Nago (CM)
1949	1985	1906
Liping (W)	Mazurkiewicz (J)	Nair (SR)
1955	1932	2045
Lodh (SB)	Mazza (G)	Nam (Y)
1885	1920	2044
Lohan (OP)	Mc Ginnis (C)	Navarro (A)
1912	2001	1902
Lonvaud-Funel (A)	McCarthy (JA)	Neviani (E)
2033	2019	1973
Lougheed (EC)	McCarthy (MJ)	Nilsen (BN)
1929	1858	2004
Lu (CD)	McGill (AEJ)	Niranjan (K)
2007	1889	1861
Lues (JFR)	McMahon (DJ)	Nishikawa (Y)
1946	1963	1870
Lukaszewski (A)	Meireles (MAA)	Norred (WP)
1898	2046	1907
Lund (DB)	Merino (ASF)	Nout (MJR)
1851	1852 1854 1856	1906
Lundstrom (K)	Merrill (JK)	Nunes (RV)
2015	2009 2010 2011	1849
MacGregor (EA)	Mielnik (M)	Odame-Darkwah (JK)
1938	2004	1871
MacNicol (PK)	Miettinen (H)	Ogasawara (J)
1904	1962	1870
Macritchie (F)	Migliore-Samour (D)	Ogundipe (AO)
1893	1989	1911
Maduagwu (EN)	Minoza-Gatchalian (M)	Ohlsson (T)
1863	2032	1859 1860
Magura (CE)	Misra (AK)	Ohta (Y)
1972	1951 1959 1974	1935 1937
Mahendrakar (NS)	Mistry (VV)	Okoshi (A)
2000	1961	1881
Mahmoud (R)	Mohan Singh	Oliver (JR)
1986	1914	1897
Maki (Y)	Molina-Cano (JL)	Ollie (DF)
1952	1903	1849
Mallet (JF)	Moorthy (BTS)	Oota (K)
1882	1885	1952
Manelius (R)	Moreira (WL)	Ortloff (C)
1915	1994	2048
Manley (M)	Moreno-Rojas (R)	Pagano (EA)
1889	1975	1910
Manzanares (P)	Moss (R)	Palomares (T)
1902	1948	2032

Panchev (I)	Rao (DG)	Salerno (JC)
1864	1921	1909
Panda (B)	Rao (DN)	Sandhu (JS)
2022	2000	2020
Pandey (NK)	Rao (KS)	Sanz (B)
2023	1885	1994
Pao (SS)	Rao (MA)	Sarathi Reddy (OV)
1964	2048	1940
Paquin (P)	Rath (SP)	Sarkar (PB)
1987	2040	1922
Parisi (E)	Rathee (CS)	Sarkar (S)
2005	1912	1951 1959 1974
Parolari (G)	Ratomahenina (R)	Sarojini (G)
2016	1983	2042
Patil (MN)	Ravindranath (K)	Sastry (SK)
2039	1941	1855 1923
Pawar (VS)	Reddy (SM)	Sathwane (KN)
1917	1880	1862
Payne (FA)	Reid (A)	Sato (T)
1964	1909	1952
Pedrazzoni (I)	Reinbold (RS)	Sauve (P)
1876	1979	1977
Pellegrini (N)	Reine (AH)	Savello (PA)
1886	1956	1986
Perez (E)	Relkin (P)	Schaefer (DM)
1925 1926	1957	2002
Peterson (CJ)	Reverbel (JP)	Scheller (KK)
1898	1983	2002
Pettersson (D)	Richter (RL)	Schivazappa (C)
1950	1956	2016
Pilhofer (GM)	Rivemale (M)	Schofield (JD)
1858	1983	1891
Ponce (E)	Robe (GH)	Schutz (MM)
1998	2012	1966
Pouliot (Y)	Rodriguez (JM)	Sejrsen (K)
1987	1994	2003
Poutanen (K)	Rombouts (FM)	Sendra (JM)
1884 1905	1906	1902
Preston (KR)	Romero (DA)	Sheen (S)
1895	1958	1851
Preussmann (R)	Ross (EW)	Shelton (DR)
1863	1846	1898
Quail (K)	Royo (C)	Sherief (PM)
1948	1903	2028
Radhakrishnan (CK)	Rubio (A)	Shimamura (S)
2027	1903	1952
Ramachandran (A)	Rusul (G)	Shimazaki (K)
2025	2035	1952
Ramaswamy (H)	Rutledge (DN)	Shiny Sreedhar (K)
1916	1866	2027
Ramaswamy (HS)	Sahoo (K)	Shrivastav (AK)
1845	1885	2022
Ramesh (BS)	Saikia (L)	Sila Bhattacharya
2000	2049	2047
Randall (PG)	Saini (SPS)	Simpson (BK)
1889	2037	1845 1916
Ransing (SK)	Saini (SS)	Simpson (R)
1917	2036	1852 1854

Sinharoy (S)	Tamang (JP)	Varadarajulu (P)
2045	1922	1999
Sivala (K)	Tanaka (T)	Varma (PRG)
2043	1952	1875
Skerritt (JH)	Tao (BY)	Veena (UM)
1892	1873	2034
Skjoeldebrand (C)	Tarsem Lal	Vendrell (PA)
1859 1860	1913	1903
Skovgaard (N)	Taylor (AJ)	Venkateshwarlu (N)
1878	1998	1880
Smith (JP)	Taylor (JRN)	Ventling (BL)
1845	1889	1961
Smith (TP)	Tedga (N)	Verma (SK)
1916	1943	1944
Sobrinho (OJ)	Testolin (G)	Verma (SS)
1994	1886	2023
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1887	1927	2003
Solas (MT)	Tilly (AC)	Viljoen (BC)
2030	1896	1946
Spiegelhalder (B)	Tolmasky (DS)	Virgili (R)
1863	1909	2016
Srinivasulu (C)	Tomimura (T)	Virtanen (T)
2040	1952	1884
Srivastava (JP)	Toncheva (G)	Visser (S)
2029	1864	1978
Srivastava (SC)	Tong (C-H)	Vivier (D)
1944	1851	1983
Stahnke (LH)	Tornberg (E)	Voss (KA)
2018	2014	1907
Stamhuis (EJ)	Torres (JA)	Voutsinas (LP)
1936	1852 1854 1856	1982
Steele (JL)	Tsami (E)	Walde (SG)
1953	1924	1921
Stobbs (L)	Turgeon (S)	Walker (DK)
2009 2010 2011	1987	1954
Stuart (IM)	Ucciani (E)	Walls (I)
1904	1882	2017
Subbaratnam (GV)	Uchida (K)	Wang (W-C)
1941	1918	1855 1923
Sukhdev Singh	Ueda (Y)	Warburton (DW)
2036	1952	1877
Suortti (T)	Umrani (NK)	Webb (EC)
1884 1905	1917	1996
Surjan Singh	Usami (R)	Wedzicha (BL)
1913	1881	1865
Suryaprakash (S)	Uttaro (B)	Welsh (GC)
2034	2009 2011	1850
Suryavanshi (GB)	Van der Velde (F)	Westerlund (E)
1917	1984	1896
Suvendu Bhattacharya	Van Dijck (WGFM)	Whipple (G)
2047	1984	1997
Swanston (JS)	Van Niekerk (WA)	Wiederholt (KM)
1903	1996	1953
Swartzel (KR)	Van Roon (PS)	Wijts (SC)
1849	1995	2048
Symons (S.J)	Van Vliet (T)	Wilson (IG)
1895	1995	1879

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antagonism between lactic acid  
 bacteria of wines 2033

## **Yeast baker's**

dough, microorganisms in post  
 fermented 1946

## **Yeasts**

feta cheese, yeast growth in 1983

sausages, gamma irradiation &  
 yeasts of British 2019

## **Yersinia enterocolitica**

beef, temp. & *Y. enterocolitica*  
 growth in cooked 2006  
 meat/delicatessen, *Y.*  
*enterocolitica* in supermarket  
 1992

## **Zinc**

cheese, processing & Zn in  
 Manchego type 1975

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Printed and published by Director, Central Food Technological Research Institute,  
Mysore 570 013, at CFTRI Printing Press. Editor: Shri K. A. Ranganath.  
CFTRI, Mysore.